Telephone Engineer

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Attend Your State Convention

The next four months will see the crest of activity of state telephone associations in holding conventions. February with three, Nebraska, Georgia and Wisconsin, leads the list. Then follows March with two, Oklahoma, and Texas, and April, likewise with two, Ohio and Iowa. May comes along with the Indiana meeting.

Advance notices of all of these meetings indicate programs of great interest filled with matters of importance and interest to the men in the industry in the various states. No live telephone men can afford to miss the convention of his state association, for in these meetings are discussed the problems that have a particular bearing on the welfare of the industry in the particular commonwealth in which he is doing business. The time to begin planning to go is now so that some last minute contingency does not prevent attendance.

Get Tools Ready Early

While some progress has been made in methods of line construction work which permit construction at all seasons of the year, yet it is a fact that for a large portion of the country, construction work of this type will largely be done during the spring, summer and autumn seasons. As the new year opens, those responsible for construction work are occupied in planning the details of the spring program and in getting orders placed for the necessary materials so that there will be no delay when weather conditions become favorable for beginning the work.

One item that is often overlooked in the assembling of construction materials is the equipment of tools and machinery that are necessary. It is not unusual that tools and equipment are brought into warehouses at the end of the season and are stored until the new season begins. From the day they are placed in storage till the day they are again needed no attention is given them. As a result, work opens up and it is found that some necessary tools are missing and other equipment is not in condition for immediate use. Delays occur until tools are ordered and shipped or equipment is put into shape.

February is a splendid month for a survey of tool and equipment material. Minor repairs can be made on digging and line tools. Ropes and lines can be inspected and tested and if repairs or replacements are necessary they can be made. Motor vehicles and trailers, even if they are used to some extent, can better be laid up for overhauling at this time of year than at any other. If all tools and equipment are put into good condition now, the first spring days that invite the beginning of work in the out-of-doors will not be lost because some needed tool or machine is not available at the time it is most required.

Will Pay Stations Pay?

The public pay station telephone has long been a fixture in the telephone service of all the larger cities. Recently there has been an increasing tendency to install such pay stations in smaller cities. Primarily this has been done with the idea of correcting the abuses which have arisen out of public use of private telephones, although there is no company that would not welcome the increased revenue which might come from this source.

The question has been asked as to where is the lower limit in size of exchange in which the installations of pay stations where charges are made for local calls may reasonably be expected to pay their way. It is obvious that no general answer can be given to such a question as conditions differ widely in different places. Several such stations

might pay well in small places like resorts frequented by visitors who are accustomed to pay station service in large cities. On the other hand, there are some towns of several thousands of population where the volume of traffic and local customs would prevent even a single station of this type from being a paying proposition.

As far as we are advised, little has been said or written on the subject and we are not advised of any studies of the subject that have been made. With the present interesting development of supplementary and special service, it would seem that the subject of pay station installations could well be made one for discussion at state and district meetings.

Why Not Local Cut Rates?

The reductions which have been made in long distance charges in the last two years may give rise in some uninformed quarters to inquiries as to why local telephone rates have not followed the downward course of the long distance rates. To any experienced telephone man, the reasons are perfectly evident, but patient explanation may be necessary to those who are not familiar with all of the economic relations within the telephone industry.

As a first step in the explanation it might be said that there has been a large increase in the volume of toll business and that the revenue from toll traffic increases with the amount of traffic. Likewise it may be said that improvements in toll plant and in operating methods have prevented the cost of handling the toll business from increasing in proportion to the increase in revenue. The longer the haul of the toll call, the greater has been the effect of these changes. No rate cuts have been found to be practicable in short haul toll traffic.

On the other side, it may be shown that no increase in local revenue follows an increase in local traffic except in a few of the larger cities where message rates are in effect. Likewise, it may be shown that there is no large increase in local business as is indicated by slow growth the number of stations in service. What growth there has been is in lower priced services as extensions and private branch exchange terminals. Increases in local traffic, unlike the case of toll traffic, do cause increases in expense on account of increased cost of labor and switching and equipment that are not compensated by increased revenue in proportion.

Another factor in the local rate situation is that rate schedules have been fixed on plant valuations that included much plant that was built years ago when all of the elements of cost that went into the plant were less than they are at present. This old plant is gradually being replaced with new plant of better quality and higher cost but no way has been found to make the new plant produce more revenue than the old plant. The possibilities of finding more economical operating methods seem to be more nearly exhausted in the local than in the toll plant.

To sum up the situation, it may be said that the toll portion of the telephone business is in an era of rapid expansion of traffic which it has found possible to handle at decreasing cost per unit. The local exchange is not having such an expansion of business and it has not been possible to find new ways of carrying on its business at a decreased cost per unit. It has required all the ingenuity of telephone engineers and managers to keep the cost of local service from increase rather than decrease.

This situation is fully understood by telephone men, but those outside the business who are not familiar with its peculiarities should be kept advised of the situation whenever the opportunity offers.

Tinkering with Commission Laws

This is the open season for attempts at legislative amendment of public service commission laws. So far as is indicated by news reports from those states where legislatures are in session there is not much chance that any of the states which have commission control will return to the old days of purely local or no regulation at all. There is, of course, the recurring demand of some cities for greater powers over utilities and there are indications of many attempts to tinker at the laws to rectify some real or fancied difficulty arising out of the application of the laws in local cases. In fact, the laws of some states are in danger of becoming a patchwork of amendments that the original intent of the act is in a fair way to becoming lost.

Observation of the operation of public service commission laws in several states seems to show that the success of the laws depends to a greater extent upon the type and character of the men that administer them rather than in details of the laws themselves. The job of a public service commissioner is in many ways an unpleasant one and commissions have got themselves into many difficulties through their own efforts to avoid some of the unpleasant things that must be done. Tendencies to play politics, to pass the buck to courts and to avoid responsibilities for their acts contribute to the bad repute of commissions in some cases.

If the commissions can be manned by the right type of appointees, selected for their knowledge of public problems and for their judicial temperament; if they will do their duties honestly and openly without fear or favor, the present commission laws in most states will function properly without further legislative tinkering.

Telephone Circuits From a General Aspect

By F. J. DOMMERQUE, Fellow A. I. E. E.

At the exhibition of means of communication in Munich a few years ago there was shown a remarkable model of an automatic telephone system proposed for rural districts in Bavaria. It represented in a most ingenious way the circuit to be used in a district not far from Munich with a number of small towns or villages of a very picturesque Alpine character, as may be seen from Fig. 1 and Fig. 2, where each village is represented by a painting painted by the celebrated landscape painter, Zeno Diemer.

The system covers a district surrounding the small country town of Schaftloch, which forms the toll center of the district to which go all calls, whether toll or long distance calls. No two villages in the district communicate directly with each other. For local calls a "companion" switch is used, and for toll calls the charge is automatically registered by a "time-zone switch" as described in a paper in the October, 1923 number of TELEPHONE ENGINEER where a similar system was explained with Weilheim as the district center.

Fig. 1 gives a general view of all the villages in the district, that is, of their pictures. Each village picture has at its side a framework, upon which is mounted automatic equipment of the type used in the village and sufficient for making two simultaneous calls from the telephone sets standing in front of the picture.

Above the pictures the circuit used in the particular village is drawn in a schematic form, so that anyone familiar with circuits can follow it through the entire district. The remarkable part of the circuit exhibit is that the path of a call is illuminated, when anyone starts a call, so that he can follow it up by looking at the circuit diagram. This exhibit is not only instructive to the telephone man, but most interesting to any layman, and it certainly must attract his attention when he sees his home village pictured before him and can make a call in view of it. In Fig. 2, a single village painting is shown with its circuit and stations, giving a clearer illustration, being a front view.

This incident was not mentioned as a boost for automatic district operation, although this would be fully justified, but to give a picture of the make-up of a simple and distinctive telephone circuit.

Every telephone man who has to do with circuits knows that a circuit in order to operate must be closed. It need not necessarily be a metallic circuit. It can be grounded; i. e., the ground may form part of the circuit; but it must provide a continuous path for the energy to flow from its source all around the circuit back to the source of energy. The conductor or conductors do not need to be wires everywhere, the air may also serve as a conductor, or rather the radio waves propagating through the air, as is the case in wireless telephony.

The telephone circuit is an electric circuit. Not all circuits are electric circuits. We have also magnetic circuits, as for instance the magnetic circuit of a dynamo, but these circuits do not interest us just now. Nor circuits which may be termed mechanical circuits, such as are used in signaling. Suppose we have a signaling box, as shown in Fig. 3. The box has a round hole in the center, which is normally dark (open). Upon a lever fastened to the ground, or upon a stand held in the ground, is carried a red disk, which, when moved from its normal position into the opening of the box, will give the desired signal. This lever can be moved from its normal position (dotted in the figure) to its signaling position by means of a rod attached to a lever at the other end. If the distance is too great for a rod, wire rope may be used, in which case, however, the signaling lever must be brought back to normal by some kind of spring arrangement. In any case this is an example of a mechanical circuit. This circuit is also a closed circuit, as the ground serves as the return conductor for the power circuit. It is not our intention to go into this mechanical circuit problem; we proceed to our telephone

CONVENTION SCHEDULE

Georgia Association of Independent Telephone companies, Ansley Hotel, Atlanta, Ga., February 19th.

Wisconsin State Telephone Association, Hotel Loraine, Madison, February 20th and 21st.

Oklahoma Utilities Association, Huckins Hotel, Oklahoma City, March 12, 13 and 14th.

Texas Independent Telephone Association, Texas Hotel, Fort Worth, March 25, 26 and 27th.

Kansas Independent Telephone Association, Topeka, April 9, 10 and 11.

Ohio Independent Telephone Association, Deshler-Wallick hotel, Columbus, April 16, 17 and 18th.

Iowa Independent Telephone Association, Hotel Des Moines, Des Moines, April 23, 24 and 25th.

Indiana Telephone Association, Hotel Claypool, Indianapolis, May 7, 8 and 9th.

Up-State Telephone Association, Seneca Hotel, Rochester, N. Y., May 22, 23, and 24th.

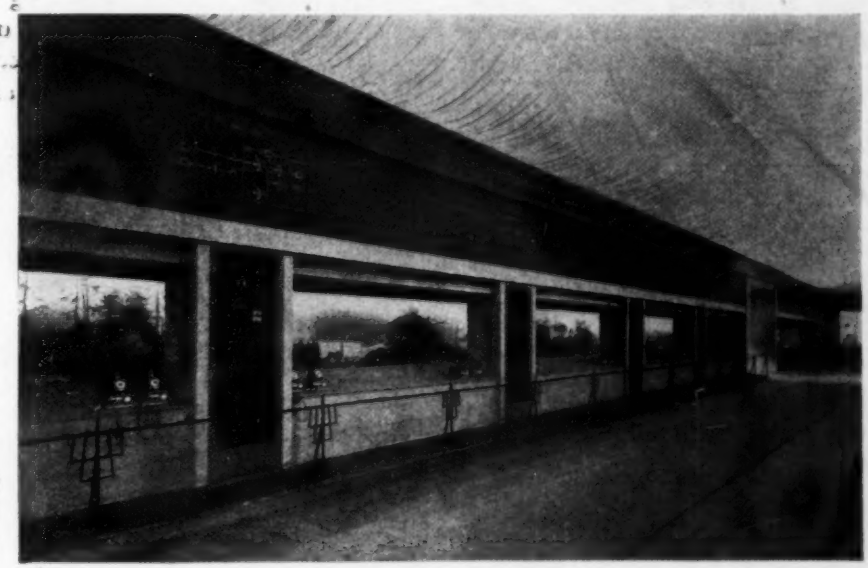

Fig. 1

circuit. Our present discussion is to be devoted to be general aspect of this circuit, therefore we need first a practical definition of what a telephone circuit consists of.

The most essential part of any circuit is its source of energy. In a telephone circuit this may be a primary battery or a secondary battery; it may be a ringing machine; it all depends on the purpose of the particular circuit for which it is to be used. Then there must be some kind of apparatus, which is operated by the energy emanating from the source of power. And finally there must be the conductors by which the apparatus is joined to the source of power. The manner in which those elements composing the circuit are joined must provide a simple, practical and economical way to accomplish the end for which the circuit is designed. The arrangement must be such that every step of the performance of the operation can be clearly identified. There are numerous ways in which a circuit may be computed from its elements, to accomplish one and the same end. It is the office of the designer to select and record on paper the best one, in order that it may serve as a guide for the practical application. There is only one way in which a circuit should be designed that is the best way. Unfortunately there does not exist a theory which would indicate this best way. Circuits are produced by conclusions that are drawn from past performances. The designer knows a multitude of physical laws and coincidences; for instance, he knows that the insertion of a condenser into a circuit blocks the passage of direct currents but permits alternating currents to pass. With his knowledge and a certain aptitude in the design of circuits he arranges the circuit elements to suit a certain performance and tries out his scheme; if it answers the purpose, well and good. If it fails to answer, he tries some other scheme until he finds a suitable one. If these were a theory of the circuit, he would know exactly what to do without experimenting. Attempts have been made to establish such a theory. There is a professor of electrical communication at a college in Europe, who, not satisfied with the haphazard way by which telephone engineers arrived at the circuits to be used in practical work, attempted to evolve a theory of circuit design. He is now at it more than twenty-five years and he cannot see the end of his efforts. He has accomplished a lot. He found the most wonderful relations, but every time he found a new relation he had to adjust the relations found previously so as to accommodate same to the new relation. His researches took him from the telephone field into the realm of electricity in general, and even into the kinematic of mechanics. He found, or at least he suspicioned, that the same laws that governed the composition of telephone and electric circuits had some relation or other with the laws underlying mechanisms forming closed kinematic circuits. Whenever his work will be crowned with success and a theory will be established by which circuits can be designed, it will be of inestimable value to the telephone fraternity.

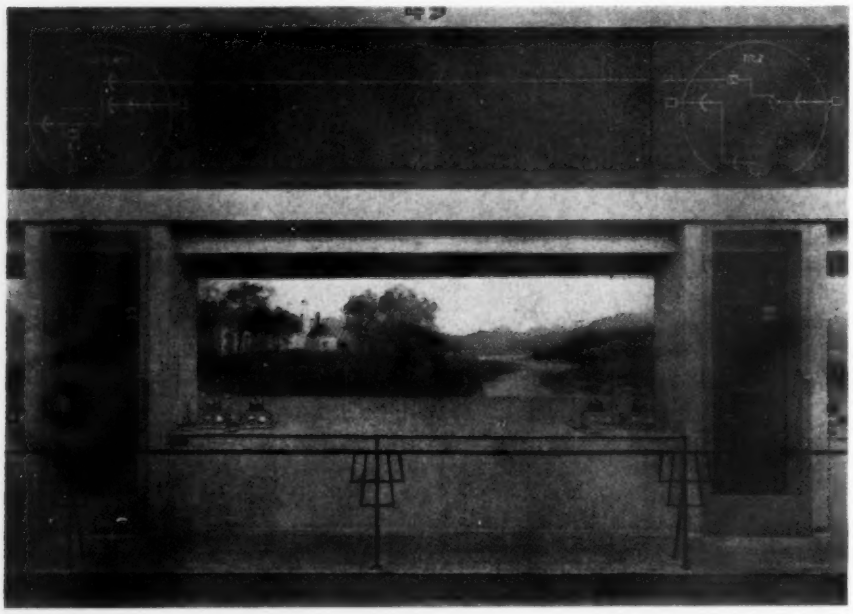

Fig. 2

As long as there is no such theory available, we have to analyze our existing circuits, determine the fundamental principles underlying each operation to be performed and build upon these principles and enlarge on them as best we can. There are features in circuit design which are characteristic of telephonic technique. In the first place the kernel of the whole telephone operation is to pave the way for the smooth journey of a telephone message from the sending end to the receiver end under all circumstances.

The subscriber's station circuit has been practically reduced to its minimum essential parts and can be considered standard, with the probable exception of the design of the induction coil, where there exists still a difference of opinion; however, this is an apparatus question which does not involve the circuit as a whole.

The line from the subscriber to the exchange, where interconnection is made between all the subscribers, is simply a metallic circuit consisting of two wires. In some exceptional cases it may be a grounded circuit, which, however, should not be used for talking, but may be used for signaling, including of ringing, when it will not interfere with the transmission of speech.

When entering the exchange the subscriber's lines are collected in cables, if this has not been done already before. But even in the latter case, cables on entering the exchange are split into 20-pair cables and go to the distributing board for cross connection. Thence they proceed to the switchboard in a manual office or to the switches in an automatically operated office. We speak for the present of manual operation as the earlier kind still in preponderance in medium sized and small telephone plants.

As the cables pass through the switchboard to the line terminals and multiple jacks in 20-pair and 63-wire cables, it is of importance that the individual lines in the cables can be identified as belonging to certain subscribers. For this purpose the covering (silk or cotton or both) of the conductors is varied according to a color code, by giving one conductor of a pair a plain color, like white, and the other one a different color. Where the single colors do not reach, a combination is effected by joining two colors on one conductor, as blue-green, blue-orange, etc. By means of this color code a line may be located anywhere in the switchboard. In addition there is the numbering of jacks and lamps. Consequently, as the line and multiple equipment of all the subscribers is the same and the individual lines and equipments can be easily distinguished by their colors and numbering, it needs only one circuit to be drawn up to have the correction scheme for all the subscribers.

As far as the cord circuit is concerned, there are as many of them provided for each operator, as calls may have to be handled by an operator at the same time in the busiest hour; for instance, 15 cord circuits in a local operator's position. As all cord circuits must be interchangeable, only one needs to be drawn up to repre-

sent the circuits. There are still a number of wires not mentioned in the above description, such as power wires; these kinds of wires are mostly common to a position and therefore they are drawn up once, as individual wires.

It is a well-known fact that in cables,

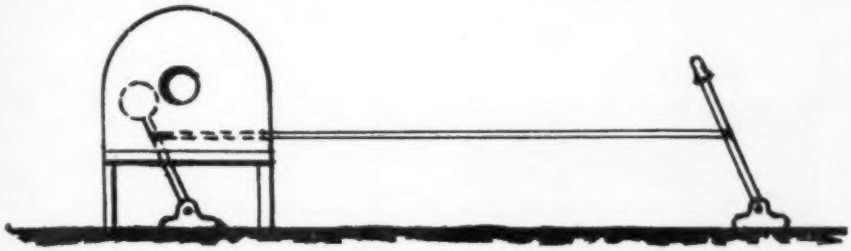

Fig. 3.

where the conductors are in close proximity, it is of importance to twist the two wires of a pair, so that the position of the wire in which the positive current flows is situated so with respect to the other wire in which the negative current flows, that any inductive effect from one wire to the other is balanced out, otherwise there would be crosstalk from one line to the other. In the cord circuits and short ends of exchange cables such twisting is immaterial, as there the inductive effects are negligible.

It would be a rather complicated affair to draw up circuits with all the apparatuses as they actually are. Therefore symbols have been used to represent such pieces of apparatus. So far these symbols have not been standardized and we find a great variation, which is very annoying. It is a curious fact that in this age of standardization the interested parties have not come to an understanding on these symbols.

We now may be able to define a telephone circuit as a combination of apparatuses flexibly arranged and grouped so as to permit the easy connection of any two subscribers for a clear and distinct conversation without disturbance and delay.

To put together such a circuit or rather a circuit combination is something like a musical composition, it requires a certain talent to accomplish it, certainly to ferret out new combinations. Not every telephone man is adapted to it, although it comes easy to learn how to read a circuit; to again use the musical simile, it is easy for a musician to learn how to read notes, but to compose is a gift.

Anyone who has to do with circuits, be it the design of new circuits or the use of existing ones, should be familiar with their fundamental principles. These principles give him the elements; if he knows these elements and studies the conditions and laws under which these elements act individually and jointly, the better able he will be to adjust his store of circuit knowledge to new requirements, just as a musician, who knows the harmonics of sounds or tones, can easily accompany songs.

The classification of circuits as indicated before into line circuits, cord circuits, etc., is not the best one for circuit analysis, as it classifies the circuits rather by the apparatus than by functions. To analyze the circuits of the past and presence in order to get at their fundamentals, it would be better to classify them as talking circuits, testing circuits, signaling circuits (which cover also the ringing circuits), etc., and then examine what constitutes the most essential apparatus for each class of circuit to function properly in its *simplest* form. Thereby a foundation will be laid to build upon the more complicated structures as they appear in modern operation.

It would be impossible to cover every phase of telephone operation, certainly when one considers the complications resulting from the invention of the electron tube. Further complication has been introduced by the enormous expansion of automatic operation in late years. Therefore a reduction of the vast conglomeration of existing circuits to fundamental principles would by itself be a great undertaking. But there are certain simple and commonly applied principles which should be known to every telephone practician and it should not be so hard a task to evolve same from the great mass of material at hand.

One must not confuse fundamental principles and theory. Theory is the establishment, from certain physical phenomena, of laws by which a science like telephony can function and is functioning in all its applications, so that there is no phase of the art or science at present, or will be in the future, that can not be explained upon the basis of this theory. Fundamental principles of the theory, which in our case means the fundamental principles of telephone circuits, constitute, as the name implies, only the foundation upon which the complete structure with all its intricate and far reaching elaboration is erected.

We did not speak of the toll and long distance circuits. The entire toll and long distance situation is at present in the state of flux on account of the introduction of the electron tube, which not only caused revolutionary changes in the circuits but also in the methods of operation. Today one can talk from New York to San Francisco and also across the Atlantic. The circuits which had to be evolved to make this possible were not completed in one day, they were added to and changed to suit ever anew appearing conditions like a house which had been enlarged from time to time by new additions. Today they have reached a point where reorganization and consolidation commences, where the old house with its numerous additions is replaced by a new and uniform building.

There is still something to be said about automatic circuits. The same conditions prevail there as in manual operation, as far as the talking and singing is concerned, and in a great deal also in testing, only the latter is performed by a switch instead by an operator. Everybody knows that automatic machinery introduces complications; so it is in a telephone exchange, where switches perform the connecting; the circuits, therefore, are also more complicated; the automatic operations must be properly timed, one step must follow the other at exactly the proper time and in the proper sequence; furthermore, the performance of the switches must be watched closely, which requires an elaborate, if not to say intricate system of signals, visual as well as audible.

Naturally the circuits to run an automatic exchange by are more complicated and it requires a high class of designers to develop new circuits and new apparatus, both developments, of course, going hand in hand. At the present date the art of automatic telephony has arrived at the point where the original rather cumbersome design of switches undergoes a refinement. The new switches are considerably more compact and simpler in construction. Although circuits remain as before, the wiring and assembling of the equipment is undergoing a refinement also. Smaller switches take less space; they can be stacked up easily so as to permit of straight and easy cabling. The circuit changes are not so much noticeable in connection with the large installations as in the smaller plants. At the beginning only comparatively large exchanges were equipped automatically, because it paid better to operate large exchanges automatically than manually. But lately the sphere of the automatisation has been extended into rural districts, where new designs of apparatus and circuits are making their appearance. This brings us back to our starting point, where we gave an exhibit of this latest development in automatic telephone engineering.

American Electric Co., Inc., Elects Officers at Annual Meeting

At the annual meeting of the American Electric Company, Inc., the latter part of January the following were elected to compose the board of directors of that organization: H. L. Harris, W. F. Benoist, John E. Fisher, W. I. Patton, G. L. Crawols, Henry C. Woods and W. E. A. Nottorf.

The board elected the following officers: H. L. Harris, president; W. F. Benoist, first vice president; John E. Fisher, vice president and general manager; W. E. A. Nottorf, vice president; G. L. Crawols, treasurer, and R. J. Munro, secretary.

John E. Fisher, who became vice president and general manager, is well known to the telephone industry. He

John E. Fisher

has been with the Automatic Electric company a number of years. He is a son of the late E. B. Fisher of Grand Rapids, Mich., where he learned the telephone business. His work enabled him to familiarize himself with the engineer problems of the industry and his ambition was to enter the manufacturing end of the business. In the course of ten years he has worked himself from the very bottom of the ladder to almost the topmost rung of the ladder as general manager of the American Electric company. His ability is unquestioned and his popularity indicates the wisdom of his organization in placing him in the responsible position he now holds.

New Officers and Directors Elected by Automatic Electric Inc.

January 25th the annual meeting of the Automatic Electric, Inc. was held at the offices of the company in Chicago.

The following board of directors were elected for the ensuing year: W. F. Benoist, Grand Pelton; T. C. Thompson, W. I. Patton, W. H. Loomis, Jr., Joseph Harris, Donald Defrees, Thomas C. Woods and Franklin G. Clement.

Following the election of directors the following officers were elected for the coming year: W. F. Benoist, president; Grant Pelton, vice president; T. C. Thompson, vice president; J. P. Hauck, treasurer, and W. I. Patton, secretary and auditor.

H. L. Gary retires as chairman of the

H. L. Harris

board, and H. L. Harris as president of the Automatic Electric, Inc. Both these gentlemen have been very active in the organization for several years. Mr. Gray as president, and Mr. Harris, as vice president, of the Theodore Gary & Co., are active in the management of that or-

W. F. Benoist

ganization, and decided to turn the active management of the Automatic over to well-deserving executives of the organization in order to give more time to their other duties. However, this organization will still have the benefit of their counsel. Mr. Harris is also executive

Hunter L. Gary

vice president of the Associated Telephone & Telegraph company.

W. F. Benoist, the newly elected president of the Automatic Electric, Inc., has been connected with this organization for many years, beginning in 1909 and coming to this company from St. Louis, Mo. During his connection with the present organization Mr. Benoist has occupied the position of sales manager, assistant general manager and treasurer. Last

T. C. Thompson

year he was elected executive vice president.

Grant Pelton, who has been with the company for several years was re-elected vice president in charge of manufacturing, production, development and research laboratories.

T. C. Thompson is another one in the organization who has worked his way up from the ranks, becoming a vice president at this meeting. He has been with the Automatic since 1903. Mr. Thompson is well-known to the industry.

Studying Telephone Methods

By E. R. COLLINS

Manitoba Telephone System, Brandon, Manitoba

CHAPTER 24

It will be impossible to discuss every type of cord circuit that has been put into use. In fact it would take several volumes to do so. Again there should be no need to publish the description or functions of many types of cord circuits. It is not wise to try to memorize any circuit, because a person's memory is a tricky thing. If the student will learn to recognize the symbols used in circuit drawings and to know the purpose and function of each piece of equipment so marked he should be able to follow any circuit no matter how complicated, with practice, of course.

That reminds me of a lady who visited with us at our home when I was a boy. This lady was totally blind, and yet she had developed the sense of touch in her finger tips to such a degree that she could detect dust on a plate when it could not easily be seen by one with good eyesight. She had several books using the Braille, or raised print. She also had a special slate for making this printing on paper. The signs consisted of dots arranged in squares and triangles. We boys watched her reading and writing with great admiration. Finally she taught us to write and read the signs, and it was great fun. But the wonder of it all disappeared as we became familiar with the signs, until it was possible for us to read and write the Braille easily. It was simply a matter of knowing the signs and using them. Now do you get the point? When you think it is too hard to master a circuit, just remember the blind lady and dig in again. When I get a new circuit I usually ask myself the question: What is the designer trying to accomplish with this circuit. Then when you have settled that in your mind go at the circuit and see how he is going to do it. Each circuit is designed to accomplish certain things, and this purpose should be sought first.

We have studied briefly the supplying of the battery to the subscriber's transmitter by the common battery system. Now a local cord circuit of the common battery type has four general purposes.

1. To supply battery to the subscriber's transmitter.

2. To provide an efficient path for the voice currents to travel from one telephone to any other.

3. To ring the bells of any telephone to be called.

4. To provide a means of notifying the operator when the subscribers want her to speak to them. This latter function is called supervision.

We have dealt with the first three functions and in this chapter we will discuss some of the supervisory features of common battery circuits.

Impedance Relay Cord Circuit

In Fig. 208 we have a circuit using two relays to feed the battery to the two subscribers connected. The battery flows through the windings of the relays to the respective telephones. The voice currents being alternating will be kept from flowing through the relay winding due to the impedance offered by them. This impedance of course will vary with the frequency of the voice current. The voice currents find a low resistance path through the 2 M. F. condensers, and so pass from one telephone to the other, passing by the path offered by the relay.

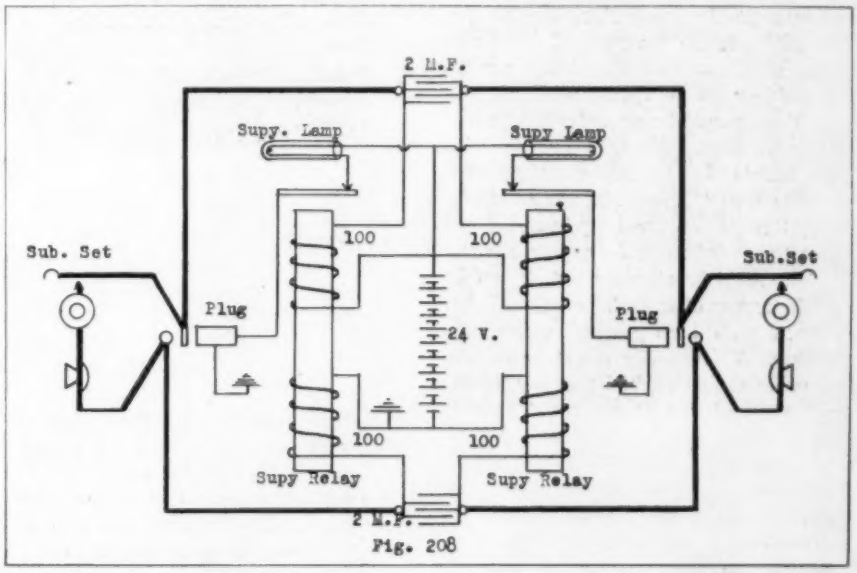

Fig. 208

When the plugs are inserted in the line jacks of any local line the tip and ring of the plug and jack make contact for the line circuit. The sleeve contact will connect the cord to ground, either direct or through the winding of a cut-off relay. If the series jack system is used, the sleeve contact may be grounded, while if the line and cut-off relay method is used, the sleeve will be taken to ground through the cut-off relay which may be about 30 ohms resistance. This of course will vary with the type of equipment used.

Suppose the plugs are in, but the subscribers have the receivers on the hooks. There will be no flow of battery over the line wires. Therefore the relay armatures will not be pulled up. We can now trace a circuit from battery through the supervisory lamp, the normal contact of the supervisory relay, the sleeve of the cord plug, and jack to ground. Both lamps will light. Now if the subscribers lift the receivers off the hooks, the battery will flow through the windings of the impedance coils and magnetize them. But we have arranged an armature on each impedance coil and now have two relays. These armatures will pull in and break the circuit to the two lamps and thus we have a means of showing the operator when the subscribers are talking and when they are finished. The lamps are out when they are talking, and when the receivers are hung up the lights will burn again. When both lamps light the operator usually pulls the connection down. This changing of the battery flow and its effect on the lamps provides what is known as *supervision*.

Fig. 208 is perhaps the simplest type of common battery circuit in use. It has the disadvantage of showing unbalances between lines in the form of noise. For a local system where lines are maintained in a good condition it provides a much cheaper type of circuit than the one shown in Fig. 209. This latter circuit is the type of cord circuit used on the No. 1 Western Electric local board. There will be variations to this, but the general scheme is the same. Here we have a repeating coil, supplying battery to the two subscribers. The tip or positive side of the cord is connected direct to the repeating coil through the talking and ringing keys, which are not shown in this drawing. The ring or negative side of

the cord is connected to the repeating coil, but has a relay connected in series. This relay is low in resistance, showing a resistance of 9 ohms on measurement. But the relay has two windings, of 18 ohms each. The one consists of many turns and is the winding of the relay coil. This coil will have impedance and the impedance will increase when the armature of the relay is pulled up as when the subscribers are talking. This impedance would have a bad effect on the voice currents which would pass through its windings were it not for the second winding which consists of a few turns of resistance wire wound over the coil in a non-inductive manner, that is, half of the wire is wound on in one direction, then is doubled back and the other half wound in the opposite direction and connected in parallel with the relay winding. This winding will not have any impedance and therefore the voice currents will find a low impedance path through the noninductive winding. We have shown the path of the voice currents in the heavy black line showing the difference in the path offered by the two windings. If the relay winding should be open the cord would talk good, but there would be no supervision as the relay would not operate. The noninductive winding has no magnetic effect. This trouble would be quickly noticed by the operators. If on the other hand the noninductive winding were open the supervision would be all right but the talking efficiency would be bad, especially if two women with high pitched voices were talking. This trouble might be detected by using a high pitched tone say of 2000 cycles, wired so that you could listen on the one cord with a head telephone while the tone is connected to the other plug. By comparing one pair of cords with another, you might detect the difference between them and then investigate the condition of the relay in the poor one. The frequency of the tone used must be high to be of any use. We will discuss in the next chapter some methods of detecting losses in talking circuits due to faulty apparatus.

The winding of the repeating coil is low in resistance to direct current but has high impedance when only one half the cord is used. If you were to connect the receiver in series with the high frequency tone to say the left plug in Fig. 209 and leave the right cord circuit open there would be very little volume to the tone heard in the receiver. Now if you were to connect the tip and ring of the right cord together while listening to the tone; on the other you would note the volume of the tone increase greatly. The load on the right half of the repeating coil lowered the impedance of the left half of the coil. When two telephones are connected the load on each half of the repeating coil would be about equal, therefore the impedance to each telephone would be about the same, the impedance of the repeating coil being lowered accordingly.

The supervisory circuit in this cord circuit is rather peculiar. When the plugs are inserted in the line jack, while the receiver is on the hook, there will be no battery flowing through the supervisory relay, so that its armature will not make contact. Now follow out the circuit starting at the cut-off relay. From ground the circuit is through the 30 ohm cut-off relay, the jack plug and cord, the 83 ohm resistance, the 120 lamp resistance to negative battery. This gives the following resistance:

Cut-off relay	30 ohms
Series resistance	83 ohms
Lamp resistance	120 ohms
Total	233 ohms

With a 24 volt battery we have 24 divided by 233 ohms = .103 amperes or

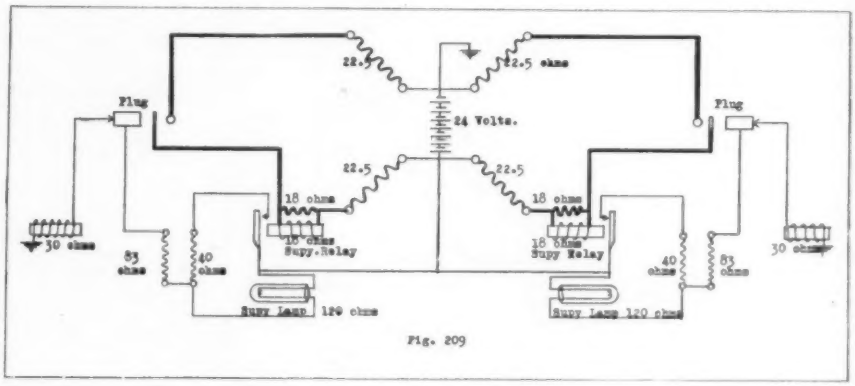

Fig. 209

103 mils. Now lift the receiver off the hook and the armature of the supervisory relay pulls up and connects the 40 ohm resistance in parallel with the lamp. The joint resistance of the 120 ohm lamp and the 40 ohm resistance will be $\frac{40 \times 120}{40 + 120} = \frac{40 \times 120}{160} = 30$ ohms. The sleeve circuit now will be as follows:

Cut-off relay	30 ohms
Series resistance	83 ohms
Parallel resistance of lamp and 40 ohms	30 ohms
Total	143 ohms

Now 24 (volts) divided by 143 ohms gives .168 amperes or 168 mils.

There will now be an increase in the current flow of the one cord of 65 mils of current, or 130 mils for the pair of cords. During the conversation the supervisory lamp will be burning dim. Take off the lamp cap and you will note that the filament is burning dim. We can find out the current flowing in the lamp now by applying ohms law. There will be a voltage drop across the lamp and the resistance in parallel equal to the voltage drop across 30 ohms with 168 mils flowing. Therefore $V = C \times R$. Or $V = .168 \times 30 = 5.04$ volts. Simply multiply .168 by 30 and you get 5040. But .168 has three decimal places, so count off three decimal places from the right of 5040 and you have 5.040 or 5.04 volts of a drop across the joint resistance of the lamp and the 40 ohms. Now the voltage drop will be the same across each portion of the joint resistance, therefore the voltage drop across the lamp will be 5.04 volts. Now using the equation $C = \frac{V}{R} = \frac{5.04}{120} = .042$ amperes or 42 mils flowing through the lamp when the subscribers are talking. This 42 mills keeps the filament warm and then when the subscribers hang up, the current in the lamp increases to 103 or an increase of 61 mills. This increase of 61 mills in the lamp brings it to brilliancy. Thus the lamp will respond to operations of the subscriber's hook switch very quickly. Otherwise with the carbon filament type of lamp the lamp might be too sluggish if the hook switch were operated quickly. The newer type of lamp using a tungsten filament does not require this arrangement.

Testing Supervisory Signals

In the previous chapter we discussed the testing of the subscriber's line relay for the average line conditions. Failure of a line signal to operate within limits affects only that line and should be quickly reported by the subscriber. Failure of the supervisory signals of a cord circuit might be common to a great number of lines and unless noticed by the operator might cause many delays to the subscribers. It is therefore very important that the supervisory signals be adjusted to meet average line conditions.

In Fig. 210 we have a test set arrangement that is commonly used for this purpose. It consists of a small box containing two switchboard jacks, a switchboard lamp and jack, two keys similar to those used for rural telephones and a switchboard cord and plug. Only the sleeve of this cord is connected as shown in Fig.

210. The lower jack can be used for making a rough test for open cord circuits. Inserting the plug in the lower jack lights the lamp of the test box. If the cord is cutting out the lamp will flash with movements of the cord. The upper jack is connected to the cord under test for supervision. The plug of the cord on the test box is inserted in any local line or multiple jack. This completes the sleeve circuit to ground through the jack or cut-off relay. A circuit can now be traced from the ring of the plug, through the 10,000 ohm resistance, through the normal contacts of the shunt and series keys to the tip of the plug. Now operate the series key and a resistance of 750 ohms is connected in series with the cord circuit. This should put out the supervisory lamp. Then release the series key and if the lamp still stays out, operate the shunt key. Unless the supervisory is sticking badly the lamp should light again. This arrangement permits the adjustment of the supervisory for a line of 750 ohms resistance, and allows for leakage of 10,000 ohms. Such a test set is quite necessary to get any uniform adjustment of the supervisory relays.

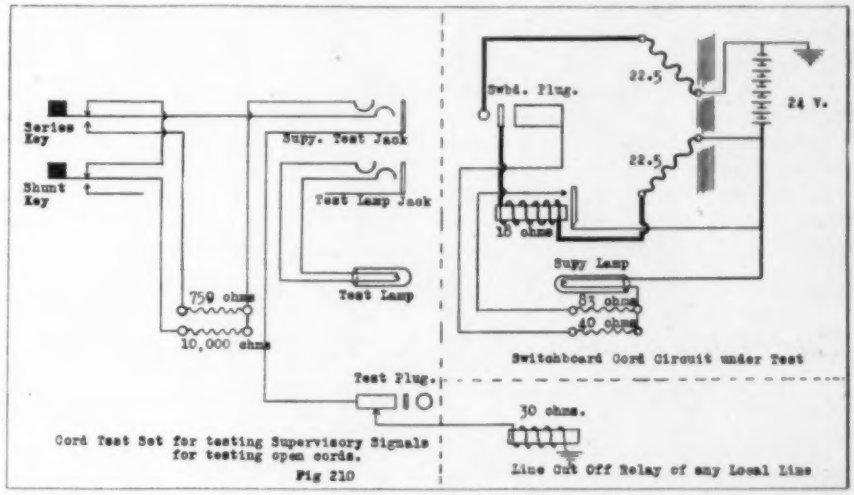

Fig 210

In Fig. 211 we find all the different features under discussion included in a complete cord circuit. Just to review some of the discussions so far let us quickly run over the different points. There is first of all the operators' talking circuit which we studied elsewhere. The transmitter circuit has a choke coil to limit the amount of battery required for the transmitter due to the 24 volts being used. With say 3 dry cells the choke coil could have been left out as the current flow would have been correct. The impedance in the choke coil is needed to prevent battery noises getting into the transmitter circuit and also to prevent the transmitter introducing too much noise into the common battery. The condenser is necessary to allow a free movement of the voice frequency set up in the primary of the induction coil and the transmitter. The impedance of the choke coil would oppose this if it were not for the condenser. The condenser also adds to the efficiency of the circuit. The secondary circuit of the induction coil receives the full force of the induction of the primaries. The secondary has two windings working together to produce a step up of voltage from the transmitter. The receiver is connected across only one winding of the secondary and therefore received only the effect of one-half of the induced current. Due to the arrangement of the 400 ohm resistance with this secondary we have a whetstone bridge arrangement whereby under certain line conditions the operator hears no sound from her transmitter. The incoming currents find a parallel path through the receiver as one branch and through the 400 ohm resistance and the impedance of the lower secondary winding. The result is that the large percentage of the incoming current passes through the low resistance and impedance of the receiver. There is then only the upper secondary in series with the receiver circuit. The 2 M. F. condenser is to prevent battery from the repeating coil of the cord circuit, flowing through the receiver circuit. This prevents depolarizing of the receiver, due to battery flowing the wrong direction. The operator's listening key of the cord circuit, when operated, connects the secondary circuit to the cord circuit, and at the same time the two inner springs of this key connect the battery to the transmitter circuit. These two springs should close contact before the secondary of the induction coil is connected to the cord. otherwise there will be a bad click in the operator's receiver. Wires 1, 2, 3, 4 will of course be common to all the listening keys of one operator's position. Sometimes these wires get interchanged when changing keys. Suppose there should be an interchange, it will be noticed when the operator uses a cord that there is a bad noise. If you have a test lamp simply a lamp jack with a wire pointer soldered to one of the lamp contacts, and a flexible cord to the other, and a snapper on the cord, you can connect the snapper to ground and touch wires 1 and 2 with the pointer of the test lamp at the key. There should be no light. Now connect the snappers to battery and test again. There should be no light.

It is always best to make the first test with the test lamp, because then all that you can do is to burn the lamp out at most. If you were to use a low resistance buzzer and dry cell you would possibly damage the buzzer and burn a fuse, or blister the springs, to say nothing to the start you often get when blowing a fuse. For an interchange it is usually the quickest way to disconnect all the wires concerned, clean the key terminals, then test out each wire separately. Pick out the wires with 24 volt battery, first using the test lamp, then with the low resistance buzzer pick out the balance.

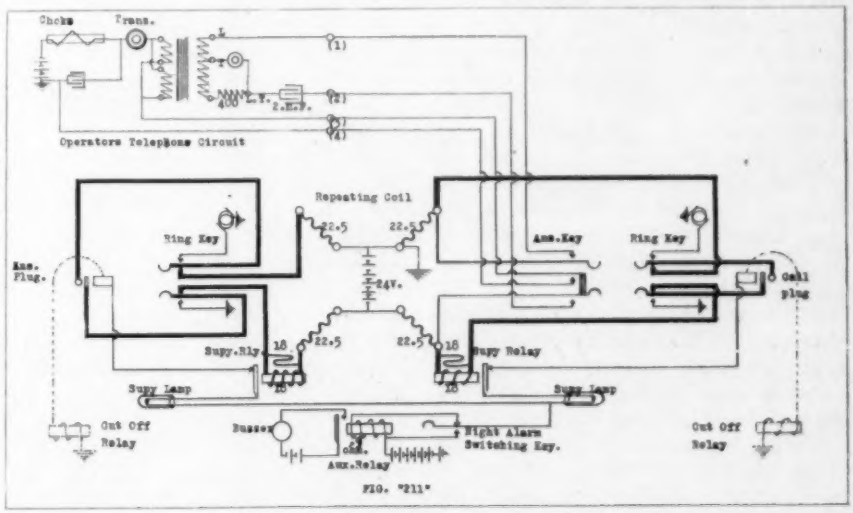

FIG. "211"

The supervisory signal arrangement in this circuit is different to that shown in Fig. 209. Here the sleeve circuit

simply connects the supervisory lamp to ground through the sleeve of the jack to ground direct, or through the cut-off relay. Battery is supplied to the supervisory lamp through a relay known as an auxiliary relay. This relay can be switched out by the night alarm switching key, and the battery supplied direct to the lamps. The lamps will burn when the supervisory relays are released, depending on the back or normal contact for their circuit. The battery when supplied through the auxiliary relay provides night alarm service to the cord circuit which is almost as important as having night alarm service on the line equipment. The switching key shown may be common to the line signals as well. The only point to remember is that the auxiliary relay must be low in resistance. This is usually about 1 ohm. If the resistance were too high, the voltage drop when several lamps were burning would be so great that the lamps would burn very dim.

In our next chapter we will discuss some experiments that the writer has been trying out for your benefit relative to detecting transmission losses in your switchboard equipment.

Meeting of Program Service Association Shows Material Progress Past Year

The meeting of the American Program Service Association held at the Hotel Sherman, Chicago, January 25th and 26th, was attended by some fifty representatives of companies furnishing radio programs to telephone subscribers and of companies investigating the matter of adding service in their exchanges.

No set program has been arranged and formal discussions relating to descriptions of property and experiences in operating them were indulged in. Much information was elicited from these discussions and the interest shown indicated that this department of the industry would become of great importance as a revenue producer.

The attitude of the nation wide broadcasting organizations was covered in an address by George K. Gann of the Tri-State Telephone & Telegraph Co. of St. Paul, Minn. He visited New York and Washington and discussed the situation with the broadcasting organizations and the American Telephone & Telegraph Co.; the amendment before congress was also discussed at some length.

The matter of the association becoming a division of the United States Independent Telephone Association was next taken up which elicited considerable comment, several favoring the idea and a few opposing it. It was decided to appoint a resolution committee to take action on this as well as other matters and report at the Saturday morning session. The following gentlemen composed the resolutions committee: L. O. Painter, St. Paul; W. S. Paca, Oil City, Pa.; R. S. Brewster, Lincoln, Neb.; Geo. B. Quatman, Lima, Ohio; and W. H. Fowler, Pella, Iowa.

F. B. MacKinnon, president of the United States Independent Telephone Association, outlined the attitude of the national organization in regard to program service and also regarding the Program Service Association becoming a division of the U. S. I. T. A.

The following resolutions were presented and after discussion unanimously adopted:

Whereas, this association does not recognize owership or control of broadcasted programs by the broadcasters.

Be it Resolved, that the members of this association go on record indicating willingness to assist and contribute in a reasonable way to the production and maintenance of programs originated by broadcasting stations and transmitted over individual program service systems, and

Be it Further Resolved, that members of this association are of the opinion that they are entitled to compensation for the distribution of certain paid advertising programs in the same proportion as broadcasting companies are paid to distribute such programs.

Whereas, it is the consensus of opinion that we, as program service companies, can better function as a division of the United States Independent Telephone Association,

Be It Resolved, that the American Program Service Association make application to the United States Independent Telephone Association for membership of program service companies, for a division of that association, similar to the plant, traffic, commercial and accounting divisions,

Be It Further Resolved, that in the event that the United States Independent Telephone Association forms a program service division and agrees to admit program service companies as members to that association, then and immediately following this action, the American Program Service shall be dissolved and its future activities be conducted as a division of the United States Independent Telephone Association.

Be It Further Resolved, that when the activities of this association are transferred to a division of the United States Independent Telephone Association, all members of this association and all other program service companies be urged to join that association immediately.

Whereas, in the spirit of co-operation, certain program service companies are now paying royalties to the American Society of Authors, Composers and Publishers for the use of certain coyrighted material.

Be It Resolved, that the officers of this association be instructed to urge all other member companies to immediately enter into similar contracts with the American Society of Authors, Composers and Publishers.

Whereas, an amendment to Section 28 of the Federal Radio act for the regulation of radio communications of February 23, 1927, has been proposed to Congress, and

Whereas, this amendment if passed will prohibit the retransmission of radio broadcast programs without permission of the broadcasting stations, thereby creating a monopoly of the air and the restriction of the development of the art,

Be It Further Resolved, that this association wishes to go on record as being opposed to any such amendment, and

Be it Further Resolved that the officers of the American Program Service Association request the United States Independent Telephone Association to notify the chairman of the Senate and House committees of the United States Congress to the effect that this association desires to be heard when this proposed amendment is under consideration by the Senate and House committees.

The association re-elected J. A. Gustafson of Abilene, Kansas, as president. R. S. Brewster of Lincoln, Nebraska, was elected secretary-treasurer.

Make Phones Here for Use of Wall Street

Chicago craftsmen at the Western Electric Company's Hawthorne works are preparing Wall street to handle repetitions of the 6,000,000-share days.

The forces at the Southwest Side plant and the company's installation experts have just undertaken the task of manufacturing and installing some 276 machine switching frames and twenty-nine manual boards in record time.

The order is being expedited in order to relieve the heavy load on the New York Telephone Company's central offices serving New York's famous financial district.

The companies comprising the Bell System spent about $1,000,000 a day in construction work during 1928.

One telephone cable often contains as many wires as eight open wire pole lines could carry, and one pole line sometimes carries several cables.

Lincoln Telephone & Telegraph Company Has Heavy Construction Program for 1929

The construction program of the Lincoln Telephone and Telegraph Company, Lincoln, Neb., calling for an expenditure of $1,800,000 in 1929, is indicated in the provisional estimates for the year according to the announcements made recently by J. H. Agee, general manager of the company. This compares with nearly $1,200,000 expended in 1928.

"These expenditures," Mr. Agee states, "are planned to provide adequately in advance for the continued growth in the telephone requirements of the public in the twenty-two counties in southeastern Nebraska served by the Lincoln Telephone and Telegraph Company. The estimates cover the necessary gross outlays in 1929 for land, buildings, switchboards, cable and various other equipment which make up telephone plant.

"As in the case of larger business institutions, the telephone company has for several years prepared annual budgets and estimates of construction needs both for one year and for five years, basing these on careful forecasts throughout its territory.

"The construction program must reflect not only the current prospective growth in telephone needs but the continuous progress that is being made in telephone science and engineering and is therefore planned with full regard to utilizing such new or improved devices and methods as will contribute to the efficiency of telephone operation and transmission.

"In the program both for 1929 and for the five year period now beginning, conspicuous place is given to the replacement and continued improvement of central office equipment, the erection or enlargement of telephone buildings to house this part of the general plant, and additions and improvements to Long Distance facilities.

"Outstanding among the construction projects will be an addition of miles of long distance lines, 2,884 miles of which will be copper wire, and the replacement of old copper wires in the Long Distance lines between Lincoln and Hastings with larger size new copper wires. Also the completion of the reconstruction of lines west from Lincoln to Emerald. In this section a large cable is being erected which will carry all the rural lines in that direction, and remove a large number of wires from the poles. Also a new pole line is being completed between Lincoln and Seward, with an increased number of poles in each mile. All these substitutions will provide more security to service—both Long Distance and Exchange, especially when the weather man releases one of those sleet storms which frequently visit us.

"Many new direct lines also will be established. To meet the rapid growth in long distance traffic and further improve this service a thoroughly adequate long distance facilities program is scheduled, including the installation of terminal repeaters which will simplify the operating practice and construction of improved toll circuits.

"The Lincoln Telephone and Telegraph Company has just completed a new telephone building and installed new common battery central office equipment at Syracuse. New telephone exchanges and equipment to replace present locations are planned for the following towns: Exeter, Dorchester, Gresham, Tecumseh, Seward and Auburn.

"The year just completed shows a satisfactory gain in the number of telephones. Records at the end of the year show that the company owns and operates more than 82,000 stations while they have long distance connections with all of the connecting companies in their territory totaling more than 24,000 telephones."

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AUTOMATIC
EPHONE EQUIPMENT

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

Continuing the subject of the unit cost derivation, from the point where the discussion was terminated in the January issue, there are still a number of accounts to be covered, as follows:

Aerial Cable Plant, Unit Costs.—The aerial cable account, as has been previously stated, includes cost of cables, suspension strand wire, cable clips and rings, cable boxes and fittings, pole seats or platforms, loading coils, potheads, protectors, sleeves, and all other material used in connection with the installation of aerial cable.

The cost of exchange aerial cable, account 242, will necessarily be slightly lower than the cost of toll aerial cable, account 252. This is due to the fact that the installation of exchange plant, as already suggested, can usually be effected more economically than the installation of the toll plant because of lower labor and cartage costs, and lower material prices.

1,000-foot section of each of the various sizes of cable under consideration, and subsequently reducing these costs per 1,000-foot section to a cost per foot basis.

Basis of Prices for Unit Costs.—There is one point which merits the most careful consideration in the preparation of unit costs for cable, or for any other type of equipment composed largely of copper, lead and the other higher-priced metals; it is that the present material prices are far above anything that has been experienced during the brief history of public utility appraisement work.

The costs given in Fig. 8 were built up several years ago, and obviously they are far below present costs. Up to a comparatively short time ago the majority of appraisal engineers considered present-day metal prices abnormal, and therefore unfair for use in the determination of the reproduction cost of utility properties.

Since the advent of the United States into the world war, however, there are many who think that costs, as of today, are not unduly high for use in appraisement work, in view of the fact that the metal market will probably continue to increase—at least to some extent—during the next few years, and that in any event the market will not undergo any appreciable decrease for four or five years to come. Whether or not this latter viewpoint is justifiable the writer is not at present in a position to say.

To be conservative, however, it is much better to use average prices for the past two, or perhaps three, years than to attempt to predicate the valuation of a telephone, or any other public utility property upon present-day prices.

Factors in Determination of Unit Costs.—It may be well to point out that the unit costs as presented in Fig. 8 and in all of the other tables in the chapters on unit costs, are merely given for illustrative purposes, and should not be used in actual appraisement work.

The reason for this is obvious: In the first place, costs are constantly varying, due to changes in material markets, and in the second place prices or unit costs which may be perfectly fair in one locality under one set of conditions may be most unfair in another locality under a different set of conditions. Local labor conditions, the distance of the property under appraisement from the material markets, local soil and climatic conditions, are all factors in the determination of fair unit costs.

Unit Costs of Miscellaneous Sizes of Cables.—It frequently happens that the appraiser of a telephone property encounters a heterogeneous collection of sizes and gauges of cable. This is especially true in the case of old plants. It is practically out of the question to ascertain individual prices for obsolete types of cable, and it is therefore suggested that the following plan be adopted in cases of this kind.

Carefully compute the cost of the standard sizes for each gauge of cable, following the method suggested in Fig. 8, and plat the results of these computations graphically. The material, labor and total unit costs may thus be determined from a curve with a sufficient degree of accuracy for all ordinary purposes.

Illustration of Cost Computation for Placing Messenger Strand.—Fig. 9 illustrates the method of computing the cost of placing messenger strand. It will be noted that, as in the case of the aerial cable, the costs are first computed on a

		Material, plus 2 per cent loss and waste			Labor							
Size.	Gauge.	Metal hangers.	Splicing material.	Total material.	Placing hangers.	Pulling cable.	Splicing cable and testing.	Teaming.	Supervising, 15%.	Total labor.	Total cost per 1,000 feet.	Cost per foot.
25	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
600	22	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
75	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
100	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
125	20	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

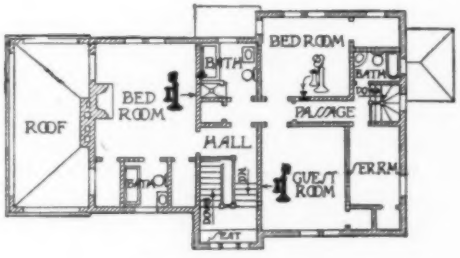
Fig. 8—Total cost per foot of placing aerial cable, using metal hangers.

The determination of the unit costs for use in the appraisal of a telephone aerial cable plant should be prefaced by a careful review of material and labor prices for the several years preceding the appraisal. Given representative material prices, it is a comparatively easy matter to build up the unit costs for each of the various types of equipment falling under the aerial cable accounts.

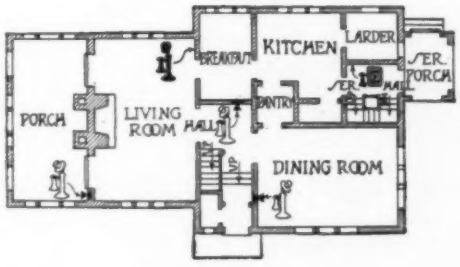
Unit Cost Per Foot of Aerial Cable in Place.—Fig. 8 shows an analysis of the total cost per foot of placing aerial cable in metal hangers, exclusive of the messenger strand from which the cable itself is suspended. It will be noted that the costs per foot in place, as given in this table, are computed by first estimating what it would cost to place a

*Consulting Telephone Engineer, 192 N. Clark St., Chicago.

Planning in Advance for Complete Telephone Convenience



SECOND FLOOR



FIRST FLOOR

Outlined telephones indicate additional outlets

Architects are learning about this new conception of comfort and smartness in the home

THE modern conception of telephone convenience in the home . . . telephones throughout the house, facilities for wires and some of the apparatus *built in* for permanence and appearance . . . is meeting favor among architects.

They realize the possibilities for added comfort and smartness that this new conception gives. By planning telephone arrangements in advance, a maximum of convenience can be assured at little extra cost.

Provision can be made in architects' plans and specifications for conduits, protector cabinets, telephone cabinets, service entrances and other facilities. Outlets can then be made available in nearly every room.

Home owners can thus fit telephone service exactly to their individual requirements. Telephones in whatever rooms they desire—with the additional advantage of being able to increase or rearrange the service as needed. A growing appreciation of this new convenience is expressed by telephone subscribers everywhere.

The Bell System is carrying to the public both nationally and locally the story of complete, ***built-in*** telephone convenience. As part of this program, the attention of architects and builders is being directed to the desirability of planning in advance for greater telephone convenience. This advertising is appearing in architectural and building magazines and should be of interest to telephone companies everywhere.

basis of a 1-foot section, and then reduced to a unit cost per foot.

	5/16-in. S&MHS strand.	⅜-in. S&M strand.	½-in. S&M strand.
1,000-foot messenger strand	.....	.....	.....
10 machine bolts, ⅝ in. by 12 ins.	.....	.....	.....
10 messenger clamps	.....	.....	.....
2 2-bolt clamps	.....	.....	.....
2 thimbles	.....	.....	.....
Totals	.....	.....	.....
Add 2 per cent loss and waste	.....	.....	.....
Total labor	.....	.....	.....
Unit cost per 1,000 feet	.....	.....	.....
Unit cost per foot	.....	.....	.....

Fig. 9—Cost of placing messenger strand.

Aerial Cable Terminals.—Fig. 10 illustrates the method of building up the cost of aeriabl cable terminals, complete and ready for installation on aerial cable. To the costs as shown in the last column of this table should be added the cost of splicing the terminal to the cable. For any given size of terminal this splicing cost will necessarily be dependent upon the size of cable to which it is to be attached.

Obviously, it costs less to splice a 25-pair terminal to a 50-pair cable than it does to splice a 25-pair terminal to a 200-pair cable. A separate computation of the cost of splicing every terminal found in a large plant would necessarily be an exceedingly tedious and costly operation.

For all practical purposes the cost of splicing terminals may, with a sufficient degree of accuracy, be obtained by determining the average size of cable to which a given size of terminals is attached, and using this average cable size as a basis for estimating a unit splicing cost. For instance, if it is found that most of the 25-pair terminals of a given tupe are spliced to 50-pair cables, then the cost of joining a 25-pair terminal to a 50-pair cable may be used as a fair index of the average splicing cost for terminals of the type under consideration.

This price will hold good, even though an actual field count shows that a few of the 25-pair terminals are spliced to 25-pair cables, and a few of them to cables of sizes larger than 50-pair. An examine of the method of computing cable terminal unit costs complete, spliced to aerial cables, is shown in Fig. 11.

Number of pairs.	Type.	Total cost.	Add for average splicing.	Unit cost.	Average size cable to which leg is attached.
25	18-C	.....	.....	.....	25-pair
10	Box	.....	.....	.....	26-pair
15	Box	.....	.....	.....	15-pair
26	Box	.....	.....	.....	50-pair
50	Box	.....	.....	.....	50-pair

Fig. 11.—Cost of aerial cable terminals in place.

The Aerial Wire.—To quote the accounting instructions of the Interstate Commerce Commission, the cost of exchange aerial wire "should include the cost of exchange service wires, including insulators, sleeves and other materials used in attaching such wires to the insulators. The exchange wire includes the drop wire leading from overhead plant to the point of entrance to the building."

Toll aerial wire includes the cost of toll service wires, including insulators, sleeves and other materials used in attaching such wires to insulators. Exchange aerial wire, it will be remembered, is chargeable to the 243 account, and the toll aerial wire to the 253 account, under the provisions of the Interstate Commerce Commission's instructions for telephone accounting.

Classification of Aerial Wire Unit Costs.—Aerial wire unit costs may be divided into two general classifications, first, exchange wire, and second, toll wire.

Exchange wire may be again subdivided into exchange line wire and exchange drop wire. Insofar as the unit costs are concerned, that portion of the exchange line wire which extends into the rural districts may be considered under the head of toll aerial wire. The reason for this will be apparent when it is remembered that rural lines and toll lines are usually subject to the same construction difficulties, due to the fact that the base of supplies is more distant than in the case of city construction. Both toll and rural aerial wire costs run a little higher than the corresponding city wire costs.

Unit Cost of Aerial Wire.—Considering first the exchange line wire, Fig. 12 shows an analysis of the cost per wire mile of various sizes of bare and insulated iron wire placed in the city. It will be noted that in addition to the wire itself, the cost of the insulators, tie wires and sleeves are included as a part of the line-wire unit cost.

It often happens that No. 17 B. & S. gauge, copper-clad, steel twisted-pair wire is used in city construction in the place of bare line wire. An analysis of the cost per 1,000 feet of No. 17 B. & S. copper-clad, twisted-pair steel line wire is given in Fig. 13.

1,000 feet No. 17 C. C. steel twisted-pair wire at	.....
10 pony insulators at	.....
10 No. 17 C.C. tie wires, 8 ins.	.....
Tape and solder	.....
Total	.....
Add 2 per cent loss and waste	.....
Total material	.....
Labor, stringing	.....
Teaming	.....
Trimming	.....
Supervision	.....
Total labor	.....
Total cost per 1,000 feet	.....

Fig. 13.—City copper-clad line wire.

Number of pairs.	Type.	Cost of terminal complete.	Cost of mounts and miscellaneous material.	Cost of 7½-foot leg cable.	Cost of pothead material.	Total material.	Total material plus 2%.	Placing terminal on pole.	Assembling, fanning and making up pothead.	Total labor.	Total labor plus 15% supervision.	Total cost.
25	18-C	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	Box	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	Box	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
26	Box	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
50	Box	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Fig. 10.—Cost of aerial cable terminals ready for installation on cable.

Where the number of wires involved is appreciable, it is sometimes necessary to run the wires in what is frequently known as "lock aerial," or "aerial conduit." The cost per foot of aerial conduit construction is shown in Fig. 14. In this table it will be noticed that 1,100 feet of strand are utilized, and no deduction is made in making the unit cost per 1,000 feet. The extra 100 feet of strand are used for dead-ending purposes in putting up the 1,000 feet of the lock aerial conduit.

1,100-ft. ⅜-in. S.&M. strand at	.....
10 machine bolts at	.....

A&C Inc.

Modernization Made Profitable with *The* Monophone

The Monophone Desk Stand

Available in a variety of styles and circuit arrangements to meet every requirement of either central battery or local battery service.

The Monophone Wall Set

The Wall Set illustrated is specially designed for central battery service. A style, similar in appearance, but with generator and generator crank is available for local battery service

The swift and sure tide of public favor toward the Monophone has clearly indicated that instruments of this type will become the standard telephone. Fortunately, it is the very popularity of the Monophone that is providing the basis whereby telephone companies may modernize their telephones—retire the older instruments—and do so profitably.

The obvious advantages of the Monophone—both in convenience and appearance—are readily appreciated by subscribers and a greater rental is willingly paid for its use. Many telephone companies are finding that this additional revenue not only adequately finances the modernization of their telephones but also frequently becomes a new source of profit.

American Electric Company, Inc.

State at 64th Street - CHICAGO, U. S. A.

Branch Office and Warehouse: 7th and Wyandotte Sts., Kansas City, Mo.

	bare iron. No. 12 B.W.G.	C.C. steel. No. 10 B.&S.G.	No. 14 B.W.G. D.B.W.P. iron.	No. 12 B.W.G. D.B.W.P. iron.
1 mile wire				
48 pony insulators				
48 tie wires				
Sleeves				
Add 2 per cent loss and waste				
Total material				
Stringing and tying				
Teaming				
Trimming				
Supervision				
Total labor				
Unit cost				

Fig. 12.—City line wire costs.

10 messenger clamps at	
500 Cameron rings at	
Total	
Add 2 per cent loss and waste	
Total material	
Labor installing	
Teaming	
Supervision	
Total labor	
Unit cost per 1,000 ft.	
Unit cost per foot	

Fig. 14.—Cost of lock aerial conduit.

Drop Wire Unit Costs—An analysis of the cost of placing single iron wire drops, of various gauges and types, in the city is given in Fig. 15. The first column shows the cost of placing a bare iron wire drop; the second column the cost of placing a mixed wire drop, one bare and one insulated wire; while the first column gives the cost of placing drops consisting of two insulated single wires. The cost of placing No. 16 "Ironite" and No. 17 copper-clad, steel twisted-pair drops in the city is given in Fig. 16. Figs. 17 and 18, respectively, show the cost of placing single wire and twisted-pair drops in rural districts.

	No. 12 bare iron.	No. 12 and No. 14 bare	No. 14 D.B.W.P. iron.
164 ft. wire			
82 ft. bare			
82 ft. D.B.W.P.			
2 porcelain knobs			
Miscellaneous			
Total			
Add 2 per cent loss and waste			
Total material			
Total labor			
Unit cost			

Fig. 15.—Cost of placing city single iron wire drops.

	No. 16 ironite twisted pair.	No. 17 C.C. steel twisted pair.
90-ft. wire (circuit ft.)		
1 porcelain knob		
Miscellaneous		
Total		
Add 2 per cent loss and waste		
Total material		
Total labor		
Unit cost		

Fig. 16.—Cost of placing city twisted-pair drops.

	No. 12 bare iron.	No. 12 and No. 14 bare	No. 14 D.B.W.P. iron.
218 ft. wire			
109 ft.			
109 ft.			
1.6 wood bracket			
2.5 porcelain knobs			
Miscellaneous			
Total			
Add 2 per cent loss and waste			
Total material			
Total labor			
Unit cost			

Fig. 17.—Rural single iron wire drops.

This concludes the subject of derivation of the unit costs.

To conclude the entire series of articles it may be well to add another chapter dealing specifically with the subject of the practical use, or uses, of the appraisal.

Briefly stated, these uses may be said to consist of the following:

1st. The appraisal is of intensely practical use for rate making purposes.

2nd.—An appraisal is always required for purposes of purchase or sale.

3rd. An appraisal is necessary for purposes of refinancing and merger.

In the last two instances the appraisal may vary slightly in form from that used for rate making purposes. In other words, short-cut methods may be adopted —as the appraisals are used primarily for presentation to bankers as others who are vitally interested in purchase, sale, refinancing and merger propositions. Bankers, as a rule, do not care for detail but they are vitally interested in the results and to know that the valuation was prepared by a competent engineer.

Telephone Co. Installs Underground System

The New Prague Telephone Company of New Prague, Minn., has begun an extensive improvement program that has as its object the removal of all telephone poles and wires from Main street and the installation of an underground system along Main street from the city limits near the New Prague Foundry to the creamery, 7,500 feet of underground conduit work.

Double ducts about 3½ inches in diameter are being laid, one for present use and the other to care for future expansion requirments. The ducts are of vitrified clay and they are laid from 3 to 8 feet underground. Manholes will be constructed at convenient points along the system.

New Prague is the first city in the 2,000 population class in the state that will have an underground telephone system with conduits of this kind and with manholes of this type, in its downtown section.

James Ourada is doing the trenchwork and the telephone crew is installing the conduit work. The installation is proceeding at the rate of about 100 feet a day.

Manager S. A. Vopatek of the telephone company plans to rush the work and have the conduits installed before the freezeup if possible, so that the cables can be laid during the winter. As soon as this is accomplished, the poles and wires will be removed from Main street.

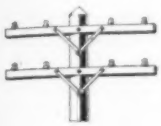
To Build Phone Office

Oxford, Mich.—About $20,000 will be spent by the Citizens' Telephone Company of Oxford, if present plans are carried out. Part of this amount will be spent in the erection of a telephone office and the rest will be for new equipment, lines and poles.

The office will be a three room structure, constructed on the site of the old telephone office. A building about 22 by 24 feet is being considered.

W. L. Agee of Marengo is the manager of the Oxford Exchange and he also has supervision over fourteen other exchanges in this section of the state.

Not all the talking in Washington, D. C., is done in the houses of Congress. During the past year telephone calls in the capitol city of the nation increased on an average of 60,000 a day, so that now, such telephone calls figure up to about 620,000 a day as compared to an average of only 560,000 a year ago.



Everything from the top *of* the pole to the bottom of the hole

GraybaR

Successor to *Western Electric* Supply Dept.

THE GRAYBAR TAG—SYMBOL OF DISTRIBUTION

THE INSULATOR. The cross-arm. The wire. The secondary rack. The spike. The lineman's spurs. His gloves. His belt. His pliers. The guy-wire. The anchor. The machine to dig the hole. The pole itself.

All from one source. All ordered on one bill. All shipped under one responsibility!

This is an everyday job for the Graybar Electric Company. This Company has contributed co-ordination to what was once the unwieldy procedure of specifying, securing and assembling the many materials for a line construction project. Graybar is returning a substantial saving annually to those engaged in this work.

The largest Western user of poles, with territories hundreds of miles in area has turned over its pole supply problem to Graybar. A railroad in the Central West, busy with maintenance and management matters, habitually places with Graybar a blanket order for all that goes into a transmission line.

What is your problem? May we look into it?

OFFICES IN 71 PRINCIPAL CITIES

GRAYBAR ELECTRIC COMPANY, Room 1501, Graybar Building, Lexington Ave. and 43rd St., New York, N. Y.

Tell us how you can help us in our problem of purchasing line material equipment.

*Name*_____

*Address*_____

_____

Who's Who in the Telephone Business

WALTER J. GALLON

An Appreciation by B. T. Sherk

In last month's issue we spoke of the many instances that could be cited where outstanding characters in the industrial fields started their business careers in a certain line of endeavor, only to switch over, in later years, to an entirely new field of endeavor, in which they ultimately became leaders in their new chosen professions.

Practically the same idea holds true with the subject of our talk this month. Mr. Walter J. Gallon, general manager of the Antigo Telephone Corporation of Antigo, Wisconsin.

Mr. Gallon was born in England in the year 1873. Was graduated from the grammar schools, finishing his education in the Northwestern Railroad Engineering Institute and left for the United States in 1896.

For three years he worked at various vocations and finally entered the services of the Wisconsin Telephone Company in 1899 where he was employed in the construction department.

Later on he was transferred to the Central Union Telephone Company in Illinois on special agent work, was promoted to Chief Inspector of the Central Union Telephone Company of Dixon, Illinois. Another transfer found him in 1904 at Janesville, Wisconsin, as exchange manager of the Wisconsin Telephone Company.

In 1907 he assumed charge of the Citizens' Telephone Company at Sheboygan, Wisconsin, and in 1917 bought an interest in the Antigo Telephone Corporation and is now sole owner.

It may be noted that Mr. Gallon has always been interested in telephone association work. He has been director of the Wisconsin State Telephone Association for 18 years. Having served in the capacity as President of the association for the past three years. And to his credit it may be said that he is also interested in civic advancement. Was on the board of directors for the Sheboygan Association of Commerce for a number of years. Has been President of the Antigo Association for the past ten years.

As one of the prominent speakers on the program of the Illinois State Telephone Convention held recently Mr. Gallon proved himself a stalwart fighter for the rights of farmers up in Wisconsin to have adequate telephone service in their homes. His speech was made before the convention Nov. 9th and is well worth your time to look it up and read it.

Walter J. Gallon.

Antigo has a population of about 9,000. The judicial seat of Langlade county, is located on the Spring Brook river and on the C. & N. W. Ry., 150 miles southeast of Ashland, 207 miles northwest of Milwaukee and 292 miles northwest of Chicago. It was originally settled in 1876 and the town laid out by the late F. A. Deleglise. The plat was recorded in July, 1882, and it was incorporated as a city in 1885. It is lighted by electricity, has broad and well-paved streets and handsome homes, has a good system of waterworks, an efficient fire department, sewerage system, a public library, good hotel accommodations, three banks thrive there. There is also a gas plant which serves the community.

The press is represented by the Antigo Journal, issued daily and semi-weekly, and two weeklies, the Antigo Banner and News Item.

There are churches of Methodist, Congregational, Baptist, Evangelical, Lutheran and Catholic denominations. The city boasts of a $25,000 High School, ward schools and Catholic and Lutheran parochial schools.

Antigo has a number of prosperous industrial concerns, included among which are saw, planing, shingle, hoop, roller flowering mill, chair factory, wagon works, electric light and power plant, and the machine shops of the C. & N. W. Ry. Co. And even in this day of the swift express trains and airplanes Antigo has a mail stage triweekly to Morley and Bavaria. The shipments embrace livestock, grain, produce, lumber and manufactured products. Express, telegraph and of course a superb telephone connection. This later connection having been built up and improved to a high state of perfection by the untiring efforts of Mr. Walter J. Gallon. Our hats are off to him and he has our best wishes for a continuance of his good work in his chosen field.

National Speakers Engaged for Oklahoma Convention

Educational and entertainment features usually found only in connection with national utility conventions are being planned by the convention committee for the eleventh annual convention of the Oklahoma Utilities Association at the Huckins hotel, Oklahoma City, March 12, 13 and 14. General sessions will be held during the morning of each day and each of the six divisions of the association will meet separately in the afternoons. Representatives, presidents and other officials of the American Electric Railway Association, National Electric Light Association, United States Independent Telephone Association, American Gas Association and other national utility organizations will address the convention, as will many other speakers of national and state-wide prominence. Leading manufacturers and dealers in machinery and equipment used by electric light and power, gas, telephone and electric railway industries will be exhibited on the parlor floor of the hotel. In addition to the sessions, leading features will be the annual reception and ball, Tuesday night, March 12, the annual banquet and entertainment, Wednesday night, March 13 and special entertainment features at the general sessions and a luncheon and entertainment for the ladies. About 1000 utility men and women are expected to attend the convention, according to E. F. McKay, manager of the Oklahoma Utilities Association.

There is a daily average of more than 862,000 local telephone calls in the city of Pittsburgh, and of 28,000 calls per day to out-of-town points.

EXTRA LIFE!

for long-lasting improved sound transmission

"YES, Son, I can hear you perfectly." And she always does on the phone serviced by Ray-O-Vac Telephone Batteries. Resonant . . . clear . . . his voice is still distinctly transmitted through the instruments long after other batteries would have ended their useful lives.

Subscribers' transmission complaints are noticeably fewer as soon as Ray-O-Vacs are put in service. Exhaustive scientific tests have proved that new Ray-O-Vac improvements in construction enable these batteries to maintain a higher level of discharge voltage than ordinary batteries. And their greater recuperative powers assure a longer useful service life.

Why not get the replacement savings and increased good will that come with this extra battery life? Just specify Ray-O-Vacs the next time you buy batteries.

FRENCH BATTERY COMPANY
Factory: Madison, Wisconsin
Sales Office: 30 N. Michigan Avenue, Chicago, Ill.
Branches: New York, Chicago, Minneapolis, Kansas City, Atlanta, Los Angeles

RAY-O-VAC

Also makers of Ray-O-Vac Radio Batteries, Ray-O-Vac Ignition Batteries, Ray-O-Vac Flashlights and Flashlight Batteries

Ramblings

By J. A. S.

Help! Help! We're sinking! Last month we mentioned the fact in this department that we were short on copies of Telephone Engineer of certain dates, and offering six months' subscription for each copy sent us. We felt sure some good friend would have pity on us and send the desired copies for our files, but we were not prepared for the deluge that followed. At the present time we have credited subscribers with forty-seven years' subscriptions and are warning friends that any copies received after this notice will be returned with dynamite. But thanks just the same. We are now convinced that this column is read.

* * *

And this reminds us of a friend who once called us up when we were engaged in the newspaper business down in Oklahoma and wanted file copies of the paper for a week back. He was told to use a porous plaster; this did not set well with the customer and we have since quit trying to be funny. But the copies asked for and furnished by our friends will serve a purpose and we thank you for them.

* * *

Phil Lenz and John Ballentine called us recently and asked if we would not join them on their trip to St. Paul to attend the Minnesota convention. Inasmuch as each was routed over a different road we found it necessary to decline one of the very generous invitations; going up on the Milwaukee road with Lenz we learned much of the radio activities over the country and the very extensive radio business handled by the Runzel-Lenz Company. This firm has been unusually busy for several years handling their telephone and radio business. But Phil recounted some of his struggles to get on top of the world, which we enjoyed very much.

* * *

Coming back we accepted the invitation of Ballentine and recounted experiences with him of our former trials and tribulations as a printer, editor and manager of publications. John is a member of the Sands Electric Company of North Chicago, and was a former employe of the Cook Electric Company, where he learned the art of making telephone protection that protects. Like most other young men, Ballentine has had his ups and downs, and is still having them (he is still a young man), but as manufacturer and salesman he is forging his way to the front.

* * *

But what we started out to say was that the railroads are finally waking up to the fact that they have had to sell their service after producing it. And the way they are doing it certainly gets results. Both at Chicago and in St. Paul we were called on the phone and a sales talk for their roads was made by the Milwaukee and the North Western representatives that brought out the very interesting equipment furnished by these roads for the accommodation of the public. And we thought that here was a good lesson for the telephone man. Why not sell the service more extensively by teaching every employe to be a salesman. Business could doubtless be increased in this way.

* * *

We still have much to learn; we confess it. We have traveled over many of the fine highways of the country and noticed the protection afforded wreckless or careless drivers by the use of posts and cable along the road in dangerous places and curves. But we never realized that this afforded another outlet for posts and poles by pole producers until the fact was mentioned at the recent meeting of the Northern White Cedar Association at Minneapolis. Modern methods open many avenues for disposal of material.

* * *

Almost weekly we receive a clip sheet from the New York Telephone Company advising us that "at a meeting of the New York Telephone Company yesterday the board of directors authorized an additional sum of ten millions for new construction." Seems like they never have a weekly luncheon that they do not appropriate a few millions for improvements, just like we would order a piece of pie for dessert.

* * *

When the Ohio Independent Telephone Association convenes at Columbus in April the name of Frank A. Knapp will be checked off as an active operator of Independent telephone properties in the Buckeye state. Although he becomes a private citizen he will always be reckoned as one of the outstanding men of the industry. His passing from active work will find expressions of regret by all who knew him, for he was always a worker for the cause he loves so well. For more than thirty years he has grown with the industry until he was the largest operator of Independent telephone properties in Ohio when he retired in January. We are glad that we have been a part of the industry because it enabled us to make the acquaintance of Frank Knapp.

* * *

Definite reports have not reached us of the actions of one Mr. G. Hog, who was supposed to make his first exit from the cellar on February 2nd. If he ever sees his shadow in Chicago he will have to climb a pole in order to do so. But from our observations, after spending a lifetime (up to the present) in the sunny south, it will take the usual six weeks for the ground and ice to melt in this section; so regardless of any splitting rays of the sun during the day of our Lord, one thousand, nine hundred and twenty-nine, February 2nd, we do not look for any real warm weather in the Chicago vicinity for at least two months.

* * *

Friends of F. A. Bowdle of Cerro Gorda, Ill. will regret to learn that he is still unable to pursue his occupation with the vim and vigor which has always characterized his activities in the past. For several months he has been confined to his home; while not in bed at all times, he has been unable to leave his home town for the work in which he has been engaged for many years. But his very efficient help has looked after his interests during this time.

* * *

Ed. Glandon has been looking after the interests of the Illinois Telephone Association during the past month, and will continue to do so pending the appointment of a secretary. Jay G. Mitchell, who has had charge of that work the past several years, resigned to enter other lines of work. Ed. is the kind of fellow that does not let the work drag and we predict that the duties of that office are being well taken care of at this time.

* * *

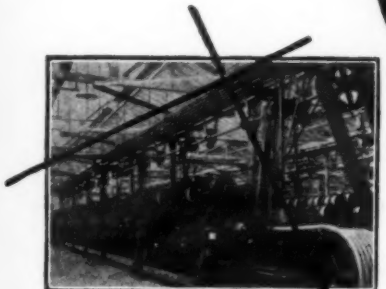
John E. Fisher, new vice president of the Automatic Electric, Inc., as well as its general manager, is a son of our late beloved E. B. Fisher of Grand Rapids, Mich. It might be well said that Dad Fisher was the father of Independent telephony. As the son of this grand old man, John had an advantage over most of the other fellows. And he has improved the opportunity too. If you haven't yet met Mr. Fisher you are the loser.

* * *

We do not know where the Copperweld Steel company ran across V. K. Curtis. But we do know that they could not have found a man better prepared to meet the public and win the confidence of the buyer quicker than does this representative of one of the best wire concerns in the country. He is always on the job and watching out for the best interests of his company. Whether you meet him morning, noon or midnight he is the same pleasant, affable gentleman and salesman.

A big sugar-deal, involving 300,000 tons of Cuban raw sugar valued at $17,000,000, was consummated recently by transatlantic radio telephone service between New York City and London. This is the largest deal in sugar ever made in one day and was made by the Czarnikow-Rionda Company of New York, through their London office, for the Cuban Export Corporation to British refiners.

The best cable shop in the country . . . ..but *it wasn't good enough*



The old way. This machine for stranding cable was the best in the country, but—

Western Electric engineers worked out a new way, stranding cable more quickly, more safely, more economically.

IN equipment and methods the Western Electric telephone cable plant of 1927 set the pace. But that didn't satisfy the company's manufacturing engineers. They put the plant in the test tube of critical judgment—and they came out with something even better.

It meant revising processes, redesigning machines, rebuilding a factory which occupied sixteen huge structures. But it was worth it!

Whether making cable or any of the 10,000 items of telephone apparatus, Western Electric seeks till it finds the better and more efficient and more economical way. As manufacturer for the Bell System this is its share in good telephone service.

Western Electric

MAKERS OF YOUR TELEPHONE,

Important Development in Telephone Acquisition By Ohio Group

By R. F. DE VOE & CO.

Another chapter has been added to the history of the Independent Telephone Industry when it was stated recently that New York interests have purchased the property of the Northern Ohio Telephone Company, the largest independent telephone system in the state of Ohio.

An article appearing on January 17, 1929, in the Bellevue Gazette, Bellevue, Ohio, indicates that this was revealed officially when Mr. Frank A. Knapp, President of the Northern Ohio Telephone Company, announced that transfer of the property from local hands to the financial interests represented by the Utilities Service Company and E. W. Sweezy of Alliance and New York, is contemplated early this year.

This marks the termination of thirty-two years' service of Mr. Knapp, who was one of the original directors and has been the guiding hand in the company's development throughout its history. He has been active during this period in both state and national telephone circles. He served as President of the Ohio Independent Telephone Association during three consecutive terms and is now a director and a member of the Executive Committee of that organization. He is also a member of the Board of Directors and Executive Committee of the United States Independent Telephone Pioneers' Association of America as well as a director and member of the Executive Committee of the Ohio Telephone News Publishing Company. Associated with Mr. Knapp during the past five years in the capacity of Secretary and Assistant Manager, has been William C. Henry, whose diligent and untiring devotion to the interests of the company and the service rendered by the several units of the organization to its many clients, has assisted greatly in the development and maintenance of the company on the high plane which has characterized its operations.

In February, 1927, Mr. Knapp combined his various telephone interests into one system under its present corporate title of Northern Ohio Telephone Company, with the assistance of R. F. DeVoe & Company, New York City, who underwrote the thirty year first mortgage 5½% bonds of the new consolidated system which were offered to the public at that time at 100 and interest.

The Northern Ohio Telephone Company today owns and operates some 44 telephone exchanges serving approximately 30,000 subscribers. It is said that negotiations for sale of all of the stock in the company has been under way for some time and the final agreement resulted in a deal involving a total consideration approaching $7,000,000. It is interesting to note that the annual Gross Revenues based upon the first eleven months earnings of 1928, shown below, aggregate about $26.38 per station while annual gross income after operating expenses, taxes assignable to operation and rentals, is equivalent to about $4.86 per station, or slightly over 2% on the investment of $230 per station represented by the $7,000,000 purchase price.

Under the plan that has been submitted, all of the first mortgage bonds will be retired at a premium of $50 for each $1,000 principal amount while the $100 par value preferred stock will be retired at a premium of $7.50 per share. The common stockholders, it was stated,

Home Company of Fort Wayne Has Extensive Improvement Budget

The budget of The Home Telephone and Telegraph Company, Fort Wayne, Ind. for 1929 includes a gross expenditure in excess of $750,000 according to an announcement made today by Harry E. Gray, general plant superintendent and chief engineer.

Included in this estimate is the additional central office equipment necessary to open the "E" office unit in the Anthony building to care for the increased amount of traffic.

Underground conduit extensions are to be installed in E. Pontiac street, and on State Boulevard from Spy Run avenue to the alley west of Clinton street.

Conduit is also to be extended from Superior to First street and west on First street to connect with existing conduit on Wells street. This project is a re-routing of conduit plant in order that the present underground cable may be abandoned from the old Wells street bridge.

The estimate includes provision for underground conduit in the new Van Buren street bridge over the St. Mary's river.

Underground cable will be placed in all the projected conduit extensions as well as relief feeder cable necessary to care for the southeast section and in the conduit run on W. Main street.

According to Mr. Gray, aerial cable construction is provided for in a member of the outlying sections, particularly the subdivisions which have built up appreciably in the past year and on other areas where considerable growth is likely to develop.

Plant rehabilitation work in the Leo, Harlan, Huntertown, and Roanoke exchanges is provided for. A number of toll circuits, required to care for the increased toll traffic, also will be added.

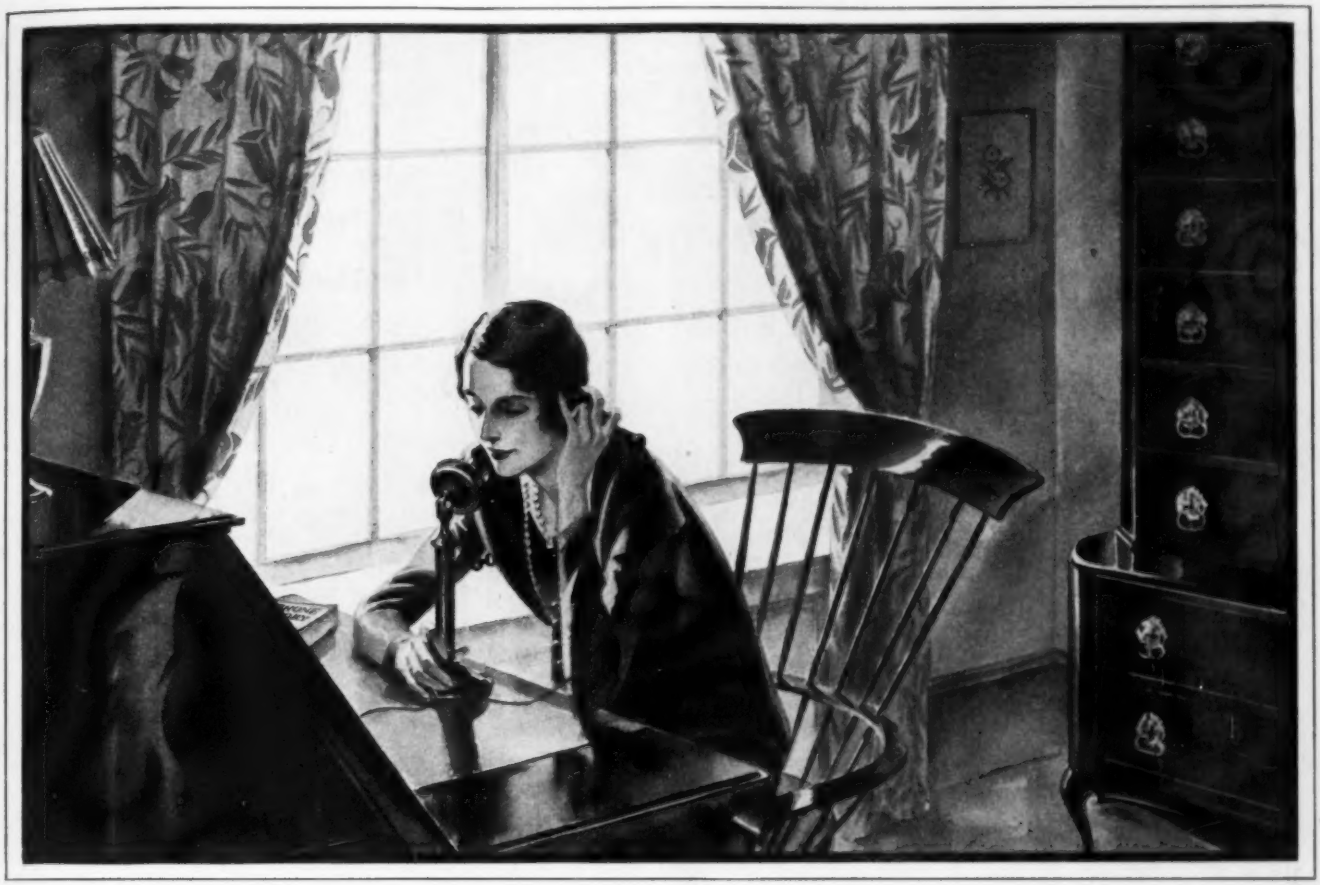
Fort Wayne Company Pays Dividend

On January 1, investors in The Home Telephone and Telegraph Company received a total of $95,295.50 in dividend and interest payments on common and preferred stocks and bonds.

A total of $62,695.50 was paid as the semi-annual dividend to more than 1200 preferred stockholders on a total issue of $1,785,250 of preferred stock.

A quarterly dividend of $17,500 was paid common stockholders while a semi-annual interest payment of $15,000 was paid holders of $500,000 of series A, six per cent gold bonds.

All Helsingfors telephone connections will be put on the automatic system by July 1st, 1929, according to an announcement of the Helsingfors Telephone Company. Work is now going forward on the third section of the installation which will complete the Helsingfors system.



There is no standing still . . .

An Advertisement of the
American Telephone and Telegraph Company

During the past two years 6000 switchboards have been reconstructed in the larger cities served by the Bell System to enable the operators to give a more direct and faster service.

Previously in towns where there were more than one central office, your operator would hold you on the line while she got the operator at the other central office on an auxiliary pair of wires. Now she connects directly with the other central office and repeats the number you want to the other operator. You hear her do this so that you can correct her if there is any mistake.

This little change cost millions of dollars. Likewise, it saves millions of minutes a day for the public and it has cut down the number of errors by a third.

It is one of the many improvements in methods and appliances which are constantly being introduced to give direct, high-speed telephone service.

There is no standing still in the Bell System. Better and better telephone service at the lowest cost is the goal. Present improvements constantly going into effect are but the foundation for the greater service of the future.

"The Telephone Books are the Directory of the Nation"

will receive a premium upon their holdings in excess of the $100 par value.

For the present at least, it was indicated there will be no changes in the policies or management of the company.

Full details of the sale including the manner in which stock transfers are to be completed, will be given all stockholders at a later date.

The purchasing group early last year acquired the telephone properties in Lima, Ohio, and were reported to have purchased the Bucyrus, Ohio, properties as well. With the inclusion of the Northern Ohio Telephone Company, this group will possess upwards of 70 exchanges in Ohio with more than 100,000 telephone connections.

NORTHERN OHIO TELEPHONE COMPANY
BELLEVUE, OHIO

Condensed Income, Expense and Earnings Statement
January 1 to November 30, 1928

Operating Revenues:	
Subscribers Station Revenues	$ 593,924.19
Message Tolls	123,619.30
Other Operating Revenues	13,806.03
Total Operating Revenues	$ 731,349.52
Operating Expenses:	
Maintenance	$ 153,292.85
Depreciation of Plant and Equipment	135,870.00
Traffic	135,280.64
Commercial	39,052.80
General and Administrative	60,338.10
Total Telephone Operating Expense	$ 523,834.39
Net Operating Revenues	$ 207,515.13
Less Taxes Assignable to Operations	67,284.72
Operating Income	$ 140,230.41
Non-Operating Income	15,629.01
Gross Income	$ 155,859.42
Rentals and Minor Deductions	10,003.54
Interest on Funded Debt	75,628.06
Amortization of Bond Discount	3,472.22
Net Income (Jan. 1 to Nov. 30, 1928)	$ 66,755.60

Balance Sheet Statement as of November 30, 1928

Assets

Fixed Capital Installed	$3,782,550.64
Investment Securities	22,720.00
Cash and Deposits	19,200.58
Employees' Working Funds	1,293.00
Bills and Accounts Receivable	41,497.30
Due from Subscribers	52,626.07
Matured Interest Receivable	620.10
Materials and Supplies	113,459.93
Sinking Fund Reserve	21,880.75
Prepaid Rents and Insurance	4,772.24
Capital Stock and Debt Discount Unamortized	116,101.41
Other Suspense Accounts	59,347.31
Total Assets	$4,236,069.33

Liabilities

Common Stock Issued	$1,453,600.00
7% Preferred Stock Issued	894,000.00
Funded Debt—30-Year 5½% Gold Bonds	1,643,000.00
Audited Vouchers and Accounts Payable	73,756.29
Interest Accrued	30,121.68
Service Billed in Advance	15,335.47
Accrued Taxes	79,986.19
Other Current and Accrued Liabilities	11,687.73
Reserve for Accrued Depreciation	7,200.71
Corporate Surplus Unappropriated	27,381.26
Total Liabilities	$4,236,069.33

Hundred Miles of Toll Cable for New York

More than 100 miles of toll cable, containing 150 pairs of telephone wires, will be placed in greater New York during 1929 by the New York Telephone Company to improve voice transmission and to provide increased facilities to meet the ever-growing demand for out-of-town telephone service. The work involves an investment of more than one million dollars.

Eight separate cable placing projects are under way, the lengths of cable to be placed in the different projects ranging from 2½ to 13 miles and extending from downtown Manhattan to central offices at the extreme limits of the Bronx, Brooklyn and Queens.

The largest single project is the placing of three cables, with a total length of 31 miles, between the New York Long Distance central office at 24 Walker street, Manhattan, and Brooklyn and Jamaica.

To further improve the transmission on these long circuits, loading pots containing the latest type of high grade permalloy loading coils will be installed in manholes at regular intervals along the route of the cable. These coils, the invention of Professor Michael Pupin, rejuvenate the voice currents which are the life of the telephone system.

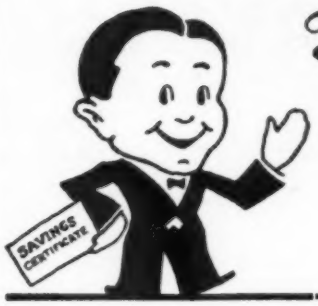
Cable is already being delivered for the first cable job and telephone engineers estimate that the entire cable placing program will be completed before the end of the year.

Telephone Company Can Enforce Deposit Rule

The Corporation Commission of Oklahoma dismissed the complaint of the University School Exchange charging the Southwestern Bell Telephone Company with refusing to give the school exchange credit for long distance telephone service unless it would make a deposit of $25 with the company to secure the payment of long distance bills. The school exchange alleged this was an unreasonable discrimination against it and asked that the telephone company be required to extend credit to the plaintiff by granting it long distance service without requiring the deposit.

Over $868,000,000 are invested in the aerial plant, including wires and poles, of the Bell telephone system in this country.

PUBLIC LIABILITY PROPERTY DAMAGE



Thrifty Bill Says

"Can you afford to gamble with the prosperity of your business?"

HOW MANY ACCIDENTS WILL YOU HAVE THIS YEAR ?

INSURE—For Safety

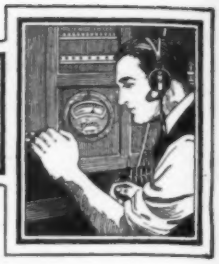
LYNTON T. BLOCK & CO.
ST. LOUIS, MO.
UNDERWRITERS OF SELECTED CLASS INSURANCE
AT A SAVING

511 Locust St. St. Louis, Mo.

Specialized Insurance for Telephone Co's.

WORKMEN'S COMPENSATION AUTOMOBILE

LINE AND DESK



KEEP PLUGS CLEAN FOR GOOD SERVICE

It does not matter how perfect the condition in which we may keep our switchboard, we absolutely have to keep our plugs clean if we expect to get maximum service and satisfaction from that switchboard.

Dirty plugs will cause cut-offs and "fading" that are very annoying and which seriously impairs speech transmission and a smooth uninterrupted service through the switchboard.

The solution to this difficulty of course is, keep the plugs clean. However, that is a tedious and painstaking duty that we are liable to put off as long as possible. By employing the old method of using a rag with some cleaning preparation and rubbing with all our might we found that the wrists and fingers became very tired and sometimes sore.

The result was that we sought a different manner in which we could clean plugs more satisfactory. The plan evolved was this. We secured a small motor that had been used on a sewing machine, it being our good fortune to secure one cheaply that had previously been in use. The pulley was removed from the shaft and two collars were found in the junk box. These collars had set screws and were used to hold in position the buffer, which we made.

The buffer was made by taking an old felt hat and cutting out circular pieces, about half a dozen in number. Holes were punched in the center. A collar was fastened to the shaft, then a couple of receiver diaphragms with holes in the centers were placed next to the collar. Following that the felt pieces were slipped on followed by another pair of diaphragms all of which were finally held compactly together by the last set screw collar.

We then took our cleaning paste and put a small amount on the buffer, started the motor, took a plug to be cleaned in hand and applied it to the buffer with the result that with a few turns of the plug against the buffer we had a clean shiny plug in a very short time.

An entire position of thirty plugs can be cleaned at least in twenty minutes time and as one becomes more proficient the time required is decreased. This apparatus has a foot control rheostat and allows the operator to easily control the speed of the motor.

There is no end to the uses to which this little motor may be placed. As an example switchboard jacks become very dirty too and where the sleeve of the jack is used for contact it is very necessary that the sleeve of the jack be kept clean also. A large number of jacks may be cleaned quickly by attaching a pistol cleaner brush to the shaft of the motor, and the motor being light weight the operator of the motor is able to apply the brush directly into the jack, the result being a bright clean jack.

After all use is the test and through use we have found this method of plug and jack cleaning to be very satisfactory and a time saving device. Contributed by Ernest Wommack.

3½ MILLION POLES USED IN 1927

According to data collected by the U. S. Department of Commerce in co-operation with the U. S. Department of Agriculture, quoted in *Wood Preserving News*, during the year 1927 3,624,833 poles were purchased by steam and electric railroad companies, electric light and power companies, and commercial telegraph and telephone companies, exclusive of approximately 60,000 small rural telephone lines having incomes of less than $10,000 per annum. Of these, 2,681,545 were reported as purchased treated. This number includes 1,021,233 pine poles, which were pressure treated, and 920,739 western red cedar and 372,030 northern white cedar poles, which were butt treated, while according to the report of R. K. Helphenstine referred to above, the treating plants reported 1,738,839 pressure-treated pine poles, and 1,112,500 butt-treated western red cedar and 431,744 butt-treated northern white cedar poles, thus indicating that many of the poles purchased untreated were treated before installation.

Number of Treated and Untreated Poles Purchased, by Kinds of Wood, in 1927 and 1925

	1927			1925		
Kind of Wood.	Treated.	Untreated.	Total.	Treated.	Untreated.	Total.
Pine	1,021,233	98,995	1,120,228	607,447	68,283	675,730
Cedar:						
Western red	920,739	220,244	1,140,983	767,245	277,049	1,044,294
Northern white	372,030	209,462	581,492	238,872	332,423	571,295
Southern white	2,845	27,457	30,302	4,697	42,894	47,591
Southern red	7,555	6,955	14,510	7,392	22,298	29,690
Chestnut	331,224	314,664	645,888	131,591	644,672	776,263
Cypress	3,370	32,560	35,930	2,509	99,211	101,720
Douglas fir	14,159	1,450	15,609	5,988	4,178	10,166
All other	8,390	31,501	39,891	2,781	21,984	24,765
Total	2,681,545	943,288	3,624,833	1,768,522	1,512,992	3,281,514

SOME DERRICK HAZARDS

The increased use of power equipment in telephone construction has introduced some hazards that have not previously existed and which call for attention to prevent the possibility of serious accidents and personal injuries. One of the most commonly used is the power winch and along with it the pole derrick. We have noted a number of serious accidents that have occurred in connection with the use of the pole derrick. In the first place is the hazard which may arise from failure of the derrick itself or, more commonly, from failure of the winch line. It is always difficult enough to see that only safe lines are used on construction jobs and where weights of the size that may be handled by a winch and derrick are involved it is doubly necessary to be sure that the lines are strong enough to handle the load safely.

Another hazard arises from the possibility that the derrick will come into contact with overhead structures especially power wires. We have read of fatal accidents due to this cause. In one case, three men were killed when the derrick came into contact with power wires. In another case, a gang, in moving poles, raised a pole out of the hole with the derrick and it was lifted to a height where the top wires came into contact with a power line. Two linemen were working on the same lines at a point several miles distant. One was killed

Specify these poles . . . *then cut your maintenance budgets for 40 years!*

PUT these strong, long-lasting Prettyman Preserved Poles of Southern Yellow Pine in your lines in 1929. Then forget them . . . forget replacement and maintenance costs until 1969. Creosoted under pressure, full length to the heartwood, they will last from 25 to 40 years—5 to 8 times the natural life of an untreated pole, which in 40 years would cost you something like 23 times its original price in replacements and labor.

Southern Yellow Pine is stronger, too. It has 44% higher static bending strength than the next strongest pole wood. Specify it and cut equipment costs by using fewer or smaller poles per given load. But be sure it is Prettyman Preserved for, however strong, untreated pine is highly susceptible to the attacks of termites (white ants) and decay-producing fungi. Write today for prices on air-seasoned Prettyman Preserved Poles, framed and treated to your own specifications.

J. F. Prettyman & Sons
Wood Preserving Plant
Charleston, S. C.

and the other was seriously burned. No doubt other cases could be cited in which similar accidents have occurred.

The occurrence of such accidents emphasize the necessity of care and good judgment in the use of modern labor saving equipment of the winch and derrick type.—Staff contribution.

HE WORKED ON BOIS D'ARC POLES

An article in the January number, regarding Bois D'Arc poles on a line near Hugo, Oklahoma, reminds me that back in 1907 there was a similar line between Paris, Texas and Hugo, and I worked on it.

We were working on it one day in front of a farm house and the lady was standing on the front porch watching us. One of the boys was up the pole working and his spur slipped and down he came. The pole being crooked and knotty it tore all the seat out of his trousers. The lady came running out to where we were and asked him if he was hurt, he went backing off from her with a sickly grin on his face, replying, "No ma'am" that is the way I come down all the time."

And if Totts Martin, who is a lineman with the Texas Light and Power Co., now sees this there will be a funeral.—Contributed by J. P. Whitson.

ACCIDENTS DON'T "JUST HAPPEN"

Prevention of accidents is the prevention of suffering, thus it has a personal appeal. The more accidents we eliminate, the more we will benefit. It is difficult to think of even one reason why we should not cooperate in this work. There are one hundred and one reasons why we should lend a helping hand and cooperate with those whose work it is to prevent such happenings that are beneficial to no one.

Statistics show that accidents do not "just happen." Accidents are caused and causes must be dealt with. The statistics are but reminders of one's duty—a duty resting upon each and every employe to prevent the causes which produce accidents. If avoidable accidents become excessive, it only means that a greater effort to perform our duty is necessary.

In the telephone business, we are particularly fortunate in having very few occupational hazards which some industries find so costly in their operation. Some of our accidents, no doubt, are caused by inefficiency, but a majority of our employes, because of their training, are intelligent and conscientious individuals. Therefore, they possess the wisdom and common sense essential to efficient and safe performance of work.

—John A. Thompson in Southern Telephone News.

Minnesota Convention at St. Paul Draws Record Attendance in 1929

Telephone conventions for 1929 are going to prove popular if the record set by Minnesota is followed by other states. The weather was bad, transportation was slow, but the attendance was above the average. One member stated that he was four hours going thirty miles by rail on account of the snow and blizzard.

The convention was held at the Lowry hotel, St. Paul, January 22, 23, and 24. The attendance was said to be a record breaker; and the interest was all that could be hoped for.

The election of officers resulted as follows:

Board of Directors: Samuel Rask, Bloomington Prairie; P. M. Ferguson, Mankato; Jay Greaves, Glencoe; A. H. Dreyer, Starbuck; G. M. Dwelle, Lake City; H. F. Lueders, Norwood; C. L. Scofield, Benson; Irving Todd, Hastings; E. L. Wright, Alexandria; and W. S. Robertson, Argyle.

The directors at a later meeting elected the following officers: Irving Todd, president; Senator S. Rask, vice president, and J. C. Crowley, secretary-treasurer.

The following extracts from President P. M. Ferguson's annual address clearly sets forth the situation in Minnesota.

"Certain it is that this last year has been rather a hectic one in the history of the telephone industry in the state.

"The so-called buying movement, continued throughout the year. There were recorded 24 sales, transfers and consolidations in the state during 1928, the principals being the two large companies which have waged a vigilant campaign to thwart the outside investment houses in buying up properties, particularly at strategical points throughout the state.

"As a result, some new faces appear among us, and a few old familiar faces will be missing at this and succeeding conventions.

"Just where this mania for mergers which may destroy individual initiative is going to lead to or when it is going to stop no one knows. Even the financiers who encouraged this trend toward consolidations are surprised at the growth of the movement to combine business into big units.

"The public attitude towards the movement at present is passive, but what may develop in the future is questionable. In any event, this movement does not square with President-elect Hoover's principles, enunciated so strongly during his campaign, of individual initiative and equality, of opportunity, and he may keep it in mind after he takes office.

"To the new owners of properties in the state I wish to reiterate my statement of a year ago—that we welcome legitimate telephone men to the state and offer our co-operation.

"The telephone business is a good business and we, who have helped develop it, are very proud of its accomplishments and the position it occupies among the great industries of the country today.

"To those who have severed the ties that bound them to the industry, we wish you godspeed; and may you never have cause to regret your action, or forget the share you contributed in building the greatest industry on earth today.

"That there will be further sales and merging of properties in the state, there is no doubt, and we can only hope that the properties concerned fall into the hands of legitimate operators, for the good of the industry."

Many interesting talks were made and matters of importance to Minnesota were discussed at this meeting.

"The Tri-State Telephone and Telegraph company invited the visitors to inspect its telephone plant and large groups made extensive rounds of the building; a visit was also made to the underground cable system, extending to all parts of the city. Later a dinner was served at the hotel St. Paul by the Tri-State company, followed by a very interesting program by the C. P. Wainman Chapter No. 18, Telephone Pioneers of America. The annual banquet was enjoyed by about four hundred guests.

Conditions in Minnesota are very satisfactory and encouraging, according to reports of operators in that state.

Iowa Independent Telephone Convention Meets at Des Moines March 23-25

Dates for the thirty-fourth annual convention of the Iowa Independent Telephone Association have been set for April 23, 24 and 25, 1929, and the place is Des Moines. The meeting will again be held at Des Moines hotel. Mark your calendar now and be on hand, for Iowa always has a good meeting.

Wisconsin Convention to Be Held at Madison, Feb. 20-21

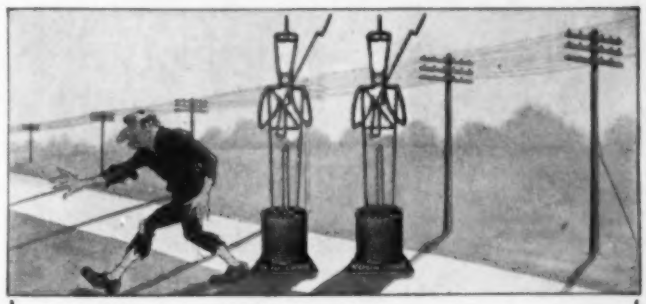
The Wisconsin State Telephone Association announces that its annual convention will be held at the Loraine hotel, Madison, Wisconsin, February 20th and 21st, 1929. As usual, this will be a very instructive as well as interesting meeting of the Wisconsin telephone fraternity, and, coming at a time where no other conventions are scheduled, should have a large attendance.

Exide
BATTERIES

With an Exide battery on the job, a long life of dependable, trouble-free service is assured. That is why Exides are so generally used by the telephone systems throughout the country.

THE ELECTRIC STORAGE BATTERY CO.
PHILADELPHIA

Exide Batteries of Canada Ltd., Toronto



KESTER SOLDER
Guards Your Lines

KESTER Flux-core Solders are the standard for telephone work—Rosin-core for inside and Acid-core for outside work—a full line of sizes in spools of various weights.

KESTER is made with the flux itself right in the core of the solder, eliminating time and money losses. Solder is your protection against increasing resistances. KESTER Flux-core Solders guard best against the resistances caused by corrosion and reduce maintenance cost.

Our laboratory is at your service to aid you in your solder problems.

Write for full information

Established 1899
CHICAGO SOLDER COMPANY
4218 Wrightwood Avenue CHICAGO

KESTER SOLDER
Rosin Core

STANDARD TELEPHONE WIRES AND CABLES

BARE COPPER WIRE
COPPER CLAD WIRE
RUBBER INSULATED WIRE
GLAZED BRAIDED WIRE
FLAMEPROOF BRAIDED WIRE
WEATHERPROOF WIRE
LEAD COVERED CABLES
ARMORED CABLES
CABLE ACCESSORIES

Standardize on STANDARD

The greatest economy results when manufacturing responsibility for telephone conductors is undivided. When the wires, cables and cable accessories are all STANDARD products, responsibility for satisfactory service rests entirely with us. *Use our complete* STANDARD *line!*

Ask us for an estimate on your next installation.

Standard Underground Cable Co.
Division of General Cable Corp.
General Offices: Pittsburgh, Pa.
BOSTON PHILADELPHIA CHICAGO ST. LOUIS
NEW YORK WASHINGTON DETROIT SAN FRANCISCO

Over many thousands of acres our wood crews go to find poles to meet your requirements

A Wood Crew whose Experience and Skill lays the Foundation for Long-Bell Quality.

The Second of a Series of Advertisements.

"... for century after century Gulf Coast hurricanes laid prostrate billions of Southern Pines. In the intervals, new forests grew ... bigger ... sturdier ... mightier than before. Eventually, Nature won .. the forests held, survivors of the fittest. Today, Southern Pines are strong and durable—*because they had to be.*" And in the heart of the Southern Pine country are thousands upon thousands of acres of Long-Bell stumpage. Through these forests our wood crews go, logging selectively for present demand, thinning young stands for future needs, insuring Long-Bell quality today, tomorrow and for years to come.

THE LONG-BELL LUMBER COMPANY
202 R. A. Long Bldg. *Established 1875* **Kansas City, Mo.**

LONG-BELL
CREOSOTED
YELLOW PINE
POLES

Bugs We Have Shot

By RAY BLAIN

Someone has said that "Variety is the spice of life" and perhaps there is no place that it proves more true than in the life of the average local trouble shooter. It is true that many people get a lot of amusement out of their work but it is not believed that anyone gets more from an eight hour day than does the average local bug hunter. Of course it was counterbalanced by a lot of misery, in the old bicycle and horse and buggy days, but now that he is generally equipped with a self-starting flivver the greater part of the misery has been eliminated.

While the majority of the troubles reported by subscribers are commonplace and easily found, it is the few that are not so commonplace that makes his work so interesting. A good trouble shooter will make a diagnosis of a difficult fault that would put a physician to shame. Even with this careful method there are some faults that are so far out of the ordinary that they will at times keep the best troublemen on the fence for days.

One of the most difficult cases of trouble that I ever experienced was down in Oklahoma several years ago in an exchange where a certain banker complained that it was seldom possible for him to hear anything over his instrument. Various routine and special tests were conducted, all of which indicated that the equipment was normal. Then the telephone was replaced without any noticeable improvement. Even after the station had been rewired and the cable pair changed he still complained that he didn't get service. In desperation the manager sent a special troubleman out to stay in the subscriber's office until the trouble was located. The first few calls the banker received were satisfactory, then the telephone rang and he was unable to hear a thing. Much shouting and "I told you so's" took place but the troubleman was on the job and saw the cause of all the trouble. He quietly asked the banker to let him see the ring he wore on his left hand. The banker looked at the troubleman as though he knew he was crazy and to humor him he removed the ring and passed it over to him. The troubleman then said, "Now go ahead and complete your call." The banker picked up the receiver and finished his call without further trouble and then looked at the troubleman as if he had changed his mind as to whom he considered crazy. The cause of the trouble was simple as many difficult faults are after they have been located. That was the day of the exposed binding posts on receivers. The banker in talking had a habit of grasping the end of the receiver in the palm of his hand in such a manner that the large ring came just right to short circuit the exposed binding posts of the receiver. When we tested his line and had him try it he would be a little self conscious and would not use the phone as was natural for him but would grasp the receiver in his fingers the way it is ordinarily used. Needless to say this man never again complained of his telephone service.

We had another case of trouble in this same exchange that caused us much concern until the special troubleman finally located it. A doctor's residence would come in permanent almost every night about the same hour and would clear up early in the morning. We tried everything but could not find what caused this peculiar trouble. We sent the troubleman out early in the morning and the line would come clear about the time he arrived at the subscriber's residence. We then started sending the troubleman out earlier each morning until one day the old doctor came to the door in his bath robe and the troubleman on going direct to the telephone found a watch hanging by its chain on one of the exposed binding posts of the receiver. The desk stand of that period used the metal in the case as one side of the transmitter circuit and in this particular hook-up one side of the receiver was connected to the stand by the watch chain. This placed a bridge across the condenser in the bell circuit and brought in the line signal. On previous mornings when the troubleman would ring the door bell the doctor would grab his watch from its accustomed place to determine the time of day before answering the door and in so doing would remove the trouble.

Another case I remember quite well that caused us considerable grief was a line that would come in permanent and when the troubleman visited the residence would find that there was no one at home. When the line cleared we would call up and find that the family had just returned. It seemed that the line would work while they were in the house but immediately they all left it quit. It was finally located by a troubleman who found that the lightning protector was used as a hiding place for the door key. The protector was mounted on the porch as was a common practice in some localities in those days and the members of the subscriber's family had the habit of laying the key across the top binding posts in such a manner that it short circuited the line. After calling their attention to this they placed the key under the door mat where it belongs and we had no more of that particular kind of trouble on their line.

I believe that the most peculiar case of trouble I ever experienced was in an apartment house when a subscriber reported that the telephone cross-talked and that conversations could be heard even when their receiver was on the hook. Various tests indicated that the instrument and wiring was normal and we were stuck until a troubleman accidentally found the cause. The trouble was due to a spare conduit system which had been installed apparently for a house telephone system which had never been placed in service. The outside telephones had been placed in the same location in each apartment and just to one side of this spare outlet box. To make a smooth job the outlet boxes had been covered with cheese cloth and then papered over. This paper acted as a diaphraghm and the connecting conduits as a speaking tube. This arrangement talked right up and when one was using the phone either above or below the apartment of the subscriber having the trouble, it sounded as if it was coming from their telephone. When using the telephone this nearby conversation to them sounded like cross-talk. We plugged the spare conduits and had no more trouble.

I believe that ladies of the present age are more careful for there was a time when it was common practice for them to use the desk stand cords for pin cushions which improved neither the telephone service nor the disposition of the trouble-shooters.

I know of one amusing case where a dear old lady complained that almost every afternoon her telephone would ring when she was trying to take a nap and when she answered would find that there was no one on the line. She would explain carefully to the manager that she needed a nap and that she wished the operators would be more careful not to bother her unless there was someone calling. Still the old lady complained in spite of the fact that the chief operator stated that her telephone was not being rung from the switchboard. The troubleman camped on the job and found that the bell ringing was not caused by the telephone at all, but by callers ringing the door bell which the old lady in her slumbers confused with the telephone.

I shall never forget the strong language used by a troubleman when he found that an installer had drilled a hole and run a wire through a sliding door that happened to be pushed back into the wall out of sight at the time. The subscriber complained that the door had refused to work since the telephone was installed and small wonder.

We had a hurry up call one morning from a subscriber that claimed his telephone had rung continuously all night. We did not think this possible but thought perhaps the bias spring was

Northern White Cedar Poles

The Lightest of Pole Woods

Northern White Cedar Poles in lines of Onaway Alpena Telephone Co., Alpena, Mich. Set in 1903.

Because of their light weight, Northern White Cedar Poles are easy to handle and easy to erect.

Yet they are *strong* and dependable because of their large percentage of heartwood . . . . only an average of ½ in. of sapwood. Their taper is ideal (one inch to every five or six feet)—giving proportionately large ground line area and solid anchorage.

Another great advantage is their economy due to their long life. You can cut gains and put on new cross arms at any time without exposing pole to decay.

Northern White Cedar Association

Minneapolis - Minnesota

Time-Tested – Why Experiment?

loose and that perhaps the bells jingled occasionally. When the troubleman entered the house, however, he found the bells ringing full blast and the family not in the best of humor due to the loss of a night's sleep. This was in the old days when twenty-five cycle current was sometimes used for house lighting and the service wires had become crossed with the telephone drop wire and was ringing the bell with a vim.

In more recent times troubles have changed somewhat in nature but are perhaps even more amusing and interesting than they were in the days past. In a small automatic exchange not long ago a subscriber complained that he could seldom get anyone over his telephone. When we tested the instrument and had him use it in our presence he had no trouble. We spied on him and found that absent mindedly he would grab the desk stand, hold the receiver and dial before removing it from the hook. He denied emphatically that he did anything so simple but he has not complained of trouble since.

On another small automatic system we had a peculiar case where two ladies complained that frequently they had difficulty in calling each other but never had any trouble in calling other numbers. We carefully observed both lines and found that it frequently occurred that these ladies would try to call each other at nearly the same time. One would remove the receiver and start dialling and before she finished the other would remove her receiver and start a call. They would each get a busy tone a few times and then hang up in disgust. The more we tried to explain the more confused they became and it was really a difficult situation. Now I have never been a believer in telepathy myself but that is the only reason I would be able to advance if I were required to give a cause why these ladies called each other at so near the same time so frequently.

Freak troubles are not always the fault of subscribers as many can be traced to irregular operation. I remember one case not so long ago on a small system where we had numerous complaints that considerable difficulty was experienced in making the operator understand. This caused us plenty grief until we accidentally stumbled onto the simple cause of the trouble. For some unknown reason even to herself one operator answered nearly every call with the calling instead of the regular answering cord. With the particular cord circuit used on this board the operator's telephone circuit was closed through the contacts of a relay operated from the sleeve of the answering cord. When the calling cord was used to answer calls the operator's set was left open until the answering cord was plugged into the calling line and it was no mystery why the operator could not be understood.

Another time in a small exchange we had numerous complaints of certain lines always being busy during the evening hours. The record of completed calls over these lines did not seem to indicate that they were overloaded so we secretly monitored the operator and located the difficulty. She was amusing herself by playing a sort of solitaire which consisted of building a toll circuit in a circle through a number of exchanges before calling herself back. On nights that she exceeded her old record of exchanges passed through she won, according to the rules of the game. Possibly it improved her geography but it didn't do the telephone service any good. It didn't take long to put a stop to this practice.

The most up-to-date complaint I have ever heard was when visiting a flying field in Ohio recently and a lady called in to the local PBX and asked the operator to please request the aviators to quit their practice of flying so low over her house as they had awakened the baby three times that morning and she was unable to complete her housework. I understood from the operator that these complaints were frequent.

The above is just a few of the reasons why a trouble shooter must develop a keen sense of humor and not a grouch if he expects to be a success. As one old timer aptly put it, "perhaps we don't make much money, but we sure do have a lot of fun."

South Dakota Holds Its Annual Convention at Sioux Falls, S. D.

South Dakota telephone men met in annual convention at Sioux Falls January 15, 16 and 17. It was declared to be one of the best meetings held in that state; the attendance was very flattering, stated the secretary.

Officers elected at the convention were: Grant E. Preston, Hitchcock, president; H. M. Schumacher, Alexandria, vice-president; Thomas Phalen, Aberdeen, secretary-treasurer. The executive committee consisting of W. W. Straight, Crooks; F. R. Irons, Chamberlain; D. T. Patterson, Sioux Falls; W. J. Brazell, Aberdeen; Ira S. Burnett, Armour; H. M. Schumacher, Alexandria, and Grant E. Preston, Hitchcock, will serve during the coming year.

In the president's address a plea for the smaller companies to cooperate with the larger Independent companies was made, as in this way they could be helpful to each other. The suspicion that the association was the "tool" of the large organizations is unfounded and unfair, it was stated. He maintained that the smaller companies needed the assistance of the association and the larger companies more than the larger companies needed their help; and urged them to lay aside their prejudices and help work for the industry.

Those prominent on the program were: C. B. Randall, vice-president and general counsel of the Tri-State Telephone & Telegraph Company of St. Paul; J. W. Raish, member of the South Dakota Board of Railway Commissioners; Miss Anne Barnes, traveling chief operator of the Iowa Independent Telephone Association, Des Moines; P. F. Bunce, traffic manager Northwestern Bell Telephone Co., Omaha; David L. Vail, president North Dakota Telephone Association; W. S. Woodward, plant supervisor, Northwestern Bell Telephone Company, Omaha, and others.

The secretary was complimented for his work and as a further mark of appreciation a purse was passed to him; this came as a complete surprise to the secretary, but was received in the spirit in which it was given.

As usual a banquet was spread on Wednesday evening and was enjoyed by several hundred members and friends. During the evening a medal offered by the National Safety Council for saving a life, was presented to Miss Iola Wilhelm, a telephone operator at Sioux Falls. Miss Wilhelm is the second woman to receive such medal.

100,000,000 Miles 'Phone Wire

It requires approximately 100,000,000 miles of telephone wire to operate the world's telephones. Of this wire mileage, approximately 68,000,000 are located in North America. Germany has the second greatest telephone mileage with 10,000,000, while Great Britain is third with 7,000,000, and Canada fourth with 3,500,000.

Improvements at Elyria, Ohio

The Elyria Telephone Company, Elyria, Ohio, has announced a $200,000 improvement program which will include the expenditure of about $90,000 this year, was announced by A. J. Curren, president, and H. O. Dutter, secretary and treasurer of the company.

The improvements are mainly in the installation of underground cables. The program calls for the laying of 12 more miles underground.

"Underground installation is considered absolutely necessary in a densely populated district," Dutter said, "and in anticipation of this we are making the installation."

Kellogg Company Announces New Wet Proof Cord

A new desk stand and receiver cord has been placed on the market by the Kellogg Switchboard & Supply Company, Chicago, which, they claim, is absolutely wet proof and has many advantages over other cords now in use.

Featured as the strong point in this new cord is the specially compounded insulation, which affords a special protection for the tinsel, yet does not harden or deteriorate—even after years of use. The fact that there are no chemicals in this new insulation that will cause this new insulation to oxidize, is considered important. They claim a substantial saving by the use of this cord.

Recently a folder was issued by the Kellogg Switchboard & Supply Company giving full particulars regarding the new receiver cord, which is yours for the asking.

C. F. Pease Company Establishes Pacific Coast Offices

As a further step to meet rapidly expanding distribution requirements for 1929, The C. F. Pease Company, Chicago, has established a new Pacific Coast Sales Office at 501 South Spring street, Los Angeles, California, under the direction of Mr. Ralph S. Gibson, Western Sales Manager, who will devote his entire attention to the Western Coast States territory.

Graybar Electric Co. Predicts Good Year

In announcing total sales of approximately $75,000,000 for the Graybar Electric Company in 1928, G. E. Cullinan, vice-president in charge of sales, declared that general economic conditions throughout the country pointed to increased prosperity for the business world during the new year of 1929.

The Graybar Company, the largest distributor of electrical goods in the world, closed the last three months of 1928 with the largest volume of sales of any quarterly period in its history.

Mr. Cullinan bases his optimism for 1929 business upon reports from the seventy-one distributing houses of his company located in strategic merchandising centers throughout the country. From these, Mr. Cullinan confidently expects his own company to show a marked increase in volume sales during the coming twelve months.

Increased efficiency in national merchandising and distributing methods witnessed during 1928 will continue to be an outstanding phase of business during 1929, according to Vice-President Cullinan. To illustrate, he explained that it was the mission of the Graybar Company to cover the United States with distributing branches from which builders, electrical contractors, and merchandising dealers can draw every conceivable line of electrical goods with the assurance that the supplies will be on hand ready for instant delivery. By this method of national distribution, whereby the local dealer can maintain a complete and up-to-date supply of electrical merchandise without actually overloading his limited store-space and financial reserve. Mr. Cullinan believes that individual initiative among both the large and small dependent dealers of the country has been preserved. In turn this is meaning instant and complete service at a minimum of overhead to the consuming public.

Through its policy of emphasizing greater efficency in distribution and merchandising during 1928, the Graybar Electric Company has today a great nation-wide distributing organization with each individual unit so strategically located that any user of electrical commodities in any part of the United States is within a few hours' distance of the nearest Graybar office. This is believed to be the most highly developed distributing system of any kind in the present-day business world.

Seven new distributing branches were added to the Graybar chain during 1928, located as follows: Rochester, N. Y.; Trenton, N. J.; Akron, O.; Flint, Mich.; Hammond, Ind.; Oklahoma City, Okla.; and Beaumont, Texas. During the last three years of the existence of the Graybar Company under its own name, it has shown over a thirty per cent increase in the number of distributing centers. Fur-

Leich Elec. Co. Rebuilt Equipment

Leich Elec. Co. wall automaphones	$ 6.00
Leich Elec. Co. P. M. receivers with rebuffed receiver shells and caps	1.00
Leich D. C. receivers complete	.50
Leich harmonic or pulsating harmonic ringers, 16-33-50-66 cycles, complete with gongs and nuts	1.00
Leich synchromonic ringers, 30-42-54-66 cycles, complete with gongs and nuts	1.25
Leich short compact type switch hook spring assemblies complete with hooks for side wall or shelf mounting	.35
Leich Elec. Co. oak bell boxes for C. B. sets with ringer and condenser and inside connections	2.00
Leich Elec. Co. compact magneto wall sets, enclosed binding post late type, 3-bar 1000 or 1600 ohm	9.00
Same with 5-bar generator	10.00

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During recent years I have been privileged to appraise Telephone Exchanges all over the United States. The list totals 663. Would you like to avail yourself of my services?
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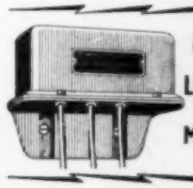
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Consulting Engineers
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Make Use of Our Combined Century of Engineering Experience

FOR SALE
2 conductor black silk desk stand and receiver cords, per set, 40 cents. W. E. No. 47 porcelain fuses, $7.00 per 100. W. E. No. 14 cable terminals, 16 pair, less stubs @ $4.00. W. E. NEW 2 conductor swbd. cords with No. 109 plugs attached, 50 cents. Galvanized steel cross arm pins, $5.00 per 100.
The Telephone Repair Shop
6966 Ravenswood Avenue
Chicago, Illinois

ther expansion as demands warrant will be carried out during 1929, Mr. Cullinan declared.

Two of the outstanding developments of the Graybar Company during 1928 were: the expansion of its electrical merchandising activities, stressing particularly those in the household appliance and radio receiver field; and the turning-over of the ownership of the company to its 2,200 employees who have purchased the entire $3,000,000 common stock issue of the company.

The Graybar Electric Company at the present time, Mr. Cullinan said, acts not only as the sole distributor for many Western Electric products in the United States, but also as the distributing agency for over 200 manufacturers whose products vary from telephone poles to pliers, and from wire to wrenches. In direct merchandising fields, which officials of the company state is one of their fastest growing lines, Graybar sells under its own name and trade-mark such items as radio receiving sets, washers, ironers, sewing machines, vacuum cleaners, fans and lighting fixtures.

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Kellogg, Dean, Stromberg or Auto. Elec. 1-M. F. condensers @	.30
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Kellogg No. 742 C. B. Steel hotel sets with straight line or 16-33-50 or 66 cycle ringers, equipped with Ind. coil Booster Ckt. @	6.75
Western Elec. No. 1333 C. B. Steel hotel set with Straight line or 16-33-50 or 66 cycle ringers, equipped with Booster Ind. and W. E. Trans. & Rec. @	6.75
Kellogg Latest type ringing and Listening Keys with ring back attachment @	2.25
Reliable Elec. 5 amp. fuses, fit Cook No. 7 Arresters, per hundred @	3.25
Kellogg No. 41 Receivers, complete with cord and re-polished shells @	1.35
Western Elec. No. 143 receivers with cord and repolished shells @	1.25
Western Elec. No. 229 or 250 transmitters with mouthpiece & back @	1.15
Western Elec. No. 329 or 323 transmitters with mouthpiece & back @	1.35
North Elec. 4-bar Bdg. hand Generators complete with crank & mounting screws @ $1.50—5-bar @	1.75
H. C. Ringing machine, motor 110 volt D. C. Generator delivers 80 volts, 20 cycle ringing current—practically new @	50.00
Kellogg or Stromberg 1000 ohm self contained ringers complete less gongs @	1.25
Kellogg No. 97 C. B. desk sets complete with No. 75 Straight line Steel signal sets @	6.75

Write for Our Bulletin

REBUILT ELECTRIC EQUIPMENT CO.
Not Inc.
1940 W. 21st St., Chicago

Sam Hand Is Improving Beggs Telephone Plant

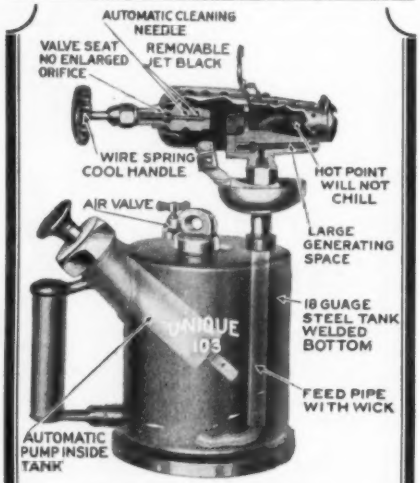
Beggs, Okla.—The telephone system here is being entirely rebuilt by Sam Hand, who bought the plant from the Goodhead company in April of last year. Improvements will include a new standard office, cable system connections to all residence and business districts and ample equipment to care for a city twice as large as Beggs. Mr. Hand is spending more than $10,000 on these improvements.

The Texas Telephone Convention

The 24th annual convention of the Texas Independent Telephone Association will be held at the Texas Hotel, Fort Worth, Texas, March 25th to 28th, inclusive. The dates are on Monday to Thursday, inclusive.

The traffic conference will be better this year. A new plan will be used whereby the traffic session is conducted something like a school. The entire field of operating will be covered by the various classes and every one attending will have an opportunity of attending all the classes or just those classes that appeal to them.

FOR SALE—Three switchboards, 50 to 150 capacity, popular makes, rebuilt; low prices. G. W. Beach, Box 146, Cedar Rapids, Iowa.



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Highest prices paid for discarded or obsolete telephone and switchboard apparatus; platinum contact relays, ring keys, etc. Have specialized in this field for many years.

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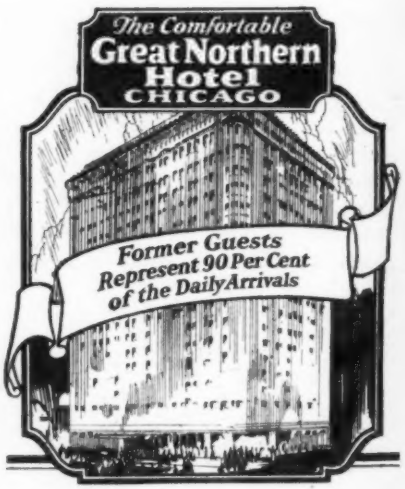

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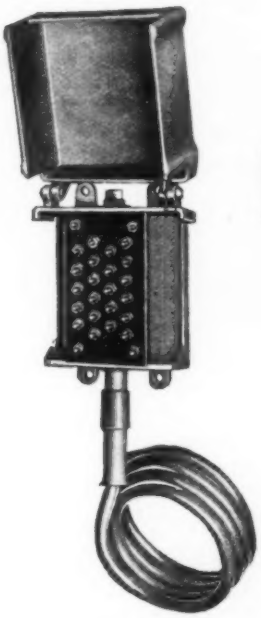
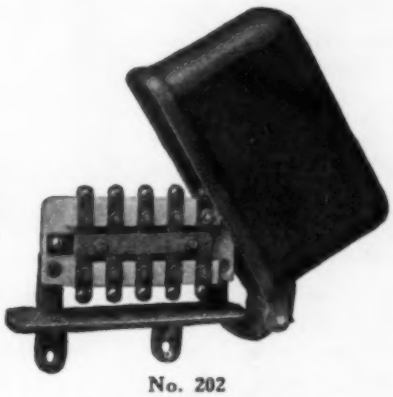


G. R. Unprotected Terminal



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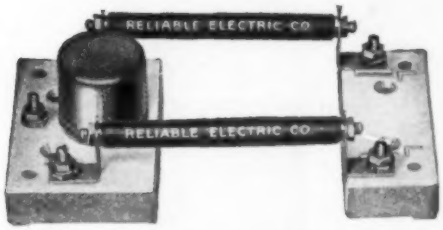

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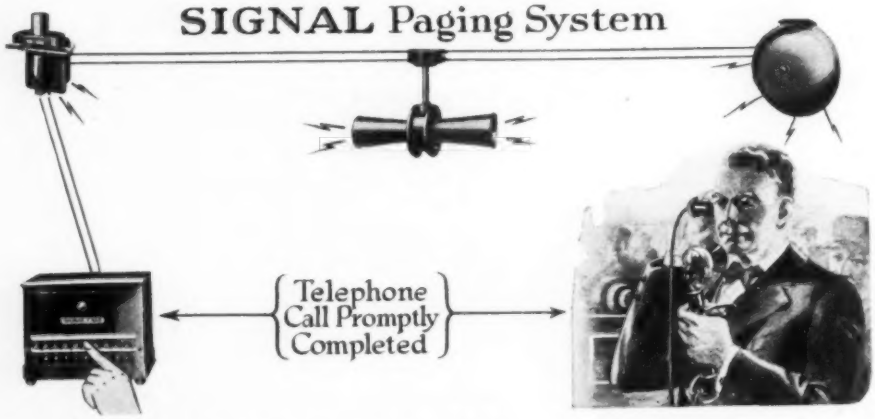

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Telephone Locking Relay set for Police and Taxicab signaling. Lower relay operates on ringing current locking-in upper relay on lighting circuit to lamp or bell. Manual reset.

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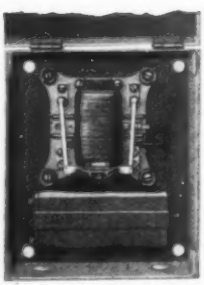

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